

COMMITTEE ON PLAN PROJECTS
(IRRIGATION & POWER TEAM)



REPORT
ON
CHAMBAL PROJECT

(MADHYA PRADESH AND RAJASTHAN)

MARCH 1958

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*Being published separately.

LETTER OF TRANSMITTAL

No. COPP/IP/92/57
COMMITTEE ON PLAN PROJECTS
NEW DELHI.

New Delhi, the 31st March, 1958

MY DEAR PANTJI,

I have great pleasure in forwarding to you the Report of the Team for Irrigation and Power on Chambal Project. The Report is the result of close study of all relevant facts and observation of necessary matters. The method followed was to consult the Project Authorities concerned at every step, the dominant thought being to do everything in close co-operation and in a spirit of joint endeavour.

2. As the work of the Team proceeded, interim reports were submitted from time to time and thus no time was allowed to be wasted for such recommendations being implemented as were agreed to and approved. The Report has the concurrence of the Consultative Committee which was appointed to advise the Team on technical questions. The main recommendations of the Team were discussed with the concerned State Authorities and the Draft Report was discussed with the Chambal Control Board. The reactions of various concerned authorities, are being placed in the form of a tabular statement in accordance with Memorandum No. COPP/7/1/5/57, dated the 7th February, 1957, of the Committee on Plan Projects to the Leader of the Irrigation and Power Team.

3. I take this opportunity of thanking you for the close personal interest you have taken in the investigation and for the guidance you gave me throughout the period of investigation and enquiry. I take this opportunity to thank the Secretary of the Committee on Plan Projects whose co-operation was invaluable and also to place on record the help and guidance which the members of the Consultative Committee made available to the Team throughout.

YOURS SINCERELY,
N. V. GADGIL.

SHRI GOVIND BALLABH PANT,

MINISTER FOR HOME AFFAIRS,
NEW DELHI.

PREFACE

The Irrigation and Power Team with Shri N. V. Gadgil as Leader was set up in February 1957 by the Committee on Plan Projects which in turn was constituted by the National Development Council. The Team was entrusted with the task of conducting investigations on the Chambal and Lakkavalli Projects with the objects detailed in para 2 with a view to securing economy and efficiency in the utilisation of financial and other scarce resources. The other members of the Team were:

Shri Lal Singh, Ex-M.P., Director of Agriculture (Retd.) Punjab.

Shri M. Narasimhaiya, Chief Engineer for Irrigation (Retd.) Mysore. Members for the Chambal Project.

Shri C. L. Handa, formerly Director Bhakra Dam Designs Directorate, Punjab.

Shri G. N. Pandit, formerly Superintending Engineer, Bombay. Member for Lakkavalli Project.

The Team was guided by a Consultative Committee consisting of senior engineers:

Shri A. N. Khosla, Vice Chancellor, Roorkee University.

Shri N. N. Iengar, Adviser, Ministry of Iron and Steel.

Shri M. S. Thirumale Iyengar, Chief Engineer, Hirakud.

Shri R. K. Gupta, Managing Director, National Projects Construction Corporation.

Shri D. S. Borker worked as Secretary to the Consultative Committee and also the Irrigation and Power Team.

2. The Irrigation and Power Team was required to make a study of various aspects of the two Projects with Special reference to:

(1) To study all aspects of the Project having a bearing on economy and efficiency with special reference to:

- (a) Utilisation of trained personnel and materials;
- (b) utilisation of machinery and equipment;
- (c) construction—Plant lay-out;
- (d) adequacy of original estimates and designs as evidenced from actual construction of the Project;
- (e) phasing of construction with a view to studying whether:

- (i) timely utilisation of benefits accruing from the Project has been ensured;
 - (ii) it is possible to accelerate accrual of benefits;
 - (iii) benefits could be increased by rephasing the Project at this stage;
 - (f) sufficiency of investigations conducted at the planning stage with a view to the formulation of Project Estimates;
 - (g) the effect of the above study on the financial results of the Project, if any.
- (2) Generally to assess the progress made in construction, the reasons for shortfall, if any, and to suggest measures for improvements in the future.
- (3) To examine the possibility of decreasing dependence upon imported materials and equipment required for the Project.
- (4) To examine whether adequate steps have been taken by the authorities concerned for fixing and realising the contemplated water rates, betterment fees and/or any other rates, cesses or taxes.
- (5) Any other recommendation that the Team may like to make in order to ensure economy and efficiency in the construction of the Project.
3. The Members of the Team made a number of visits to Chambal Hydel Works, Kotah Barrage site, Right Bank Canal and Left Bank Canal of the Chambal Project and had detailed discussions with the Chief Engineer (Irrigation) Rajasthan, Chief Engineer Chambal Hydel Works and other officials connected with the Project. The Leader along with the Members of the Consultative Committee visited the Gandhi Sagar Dam, the Canals and the Kotah Barrage from 7th to 12th July, 1957. The Team gave its interim recommendations on 10th May 1957 which were discussed by the Consultative Committee at its meeting held at Kotah.
4. The Draft Report was submitted to the Consultative Committee on 29th September, 1957. Subsequently the Team and the Consultative Committee had a joint meeting with the Central Water and Power Commission to discuss the design of Kotah Barrage. The final decision was taken after the Team visited the Site of Works on 15th January 1958 as previously programmed. They also met the Minister for Irrigation and Power informally and discussed the tentative recommendations. The Team has also the benefit of discussions with Shri S. Ratnam, Secretary to the Government of India, Ministry of Finance regarding the audit side, in particular the recommendations relating to preparation of the estimates and schedule of rates. The recommendations relating to agricultural aspects have been approved generally by the Governments of Madhya Pradesh and Rajasthan.

5. The work of the Team was considerably facilitated by the willing co-operation of the Ministry of Irrigation and Power, Central Water and Power Commission, the Governments of Rajasthan and Madhya Pradesh and the Chambal Control Board. We take this opportunity to convey our gratitude to Shri V. T. Krishnamachari, Deputy Chairman and Shri C. M. Trivedi, Member, Irrigation and Power, Planning Commission for the keen interest evinced by them in the enquiry. We also wish to record our appreciation of the valuable assistance rendered by Shri Indarjit Singh, Secretary, Committee on Plan Projects regarding the administrative and financial aspects of the Project. But for his co-operation the completion of the work and the submission of the Report would not have been an easy task.



CHAPTER I—INTRODUCTORY

The technical details of the entire scheme as finally envisaged are given in Appendix I. Briefly, it consists of three storage reservoirs, a barrage with canal system, and a power station at each of the three Dams with necessary transmission system. The cost of the scheme in the 1st stage comprising Gandhi Sagar Dam with power house, transmission lines, Kotah Barrage and the canal system—originally estimated for Rs. 48 crores is now revised to Rs. 63.6 crores. The outlay till the end of 1956-57 was Rs. 7.65 crores in Madhya Pradesh and Rs. 3.57 crores in Rajasthan, *i.e.*, a total of Rs. 11.22 crores. The Budget estimates for 1957-58 provide for an outlay of Rs. 6.6 crores.

2. The Project has undergone several changes before it was officially sanctioned in 1954 though the work was started on it in 1953. The changes in the sites of the Gandhi Sagar Dam and the Kotah Barrage, the brief history of which is given in Appendix II of the Report, necessitated several alterations with the result that it had not been possible to finalise the Project report till recently.

3. In the circumstances, the Chambal Project was deprived of the benefits of thorough investigations in the preconstruction stage. It was also not possible in view of this, to draw up precise schedules of materials, technical personnel, machinery and equipment at the time of the commencement of the Project and this has inevitably and naturally left its mark.

4. It is not our intention here to refer in detail to the necessity or validity of the various changes that were made as the circumstances were rather extraordinary in view of the existence of a number of princely states to begin with and their merger in different stages while active consideration was being given to the preparation of the Project.

CHAPTER II—ADMINISTRATION

Three dominant impressions were gathered by the Team regarding the administration of the Project:—

- (a) Notwithstanding the establishment of the Control Board, the state of co-ordinated thinking on common aspects of the Project leaves considerable margin for improvement. The Team would particularly draw attention to the inability of the two Governments or the Control Board to undertake planning of utilisation of benefits in time having regard to the targets fixed for the release of the impounded waters. The functions of the Board require that it should decide upon stage development with a view to securing the best use of the water available. It is of course the primary function of the State Government to think on this matter on an urgent basis. Agricultural planning and digging of field channels are two pre-requisites for the proper utilisation of water. The former requires experimentation for at least 2–3 years ahead of the target date and the latter is a task of complex nature, the scheduling of which has to begin equally in advance. In neither case has anything been done tangibly so far. The Control Board consists of experienced personnel from the Centre and the State and, in the opinion of the Team, it should provide a motive force for thinking on this vital subject.
- (b) The functions of the Control Board also require that the preparation of detailed estimates* and Schedules* of Rates should be expedited. The Team found that much leeway remained to be made up in this matter. Most of the difficulties between the Chief Engineer and the Financial Adviser arise from lack of existence of these two documents in their proper form. In fact, the Control Board had to take decisions several times to condone some of the irregularities committed which could have been avoided had the preparation of the said documents been completed. A list of major irregularities of this type that were condoned is given in Appendix III (A).
- (c) The third factor to which attention may be drawn relates to the inordinate delay that takes place in the implementation of the decisions taken by the Board. It will be observed from

*It is understood that estimates and schedules of rates are now ready.

the detailed study (Appendix III-B) made by the Secretariat of the Committee on Plan Projects that even relatively minor questions are not finally disposed of for months together. The Board was set up especially to expedite decisions on administrative and technical questions but if they are implemented with such a time lag as at present, the very purpose of the existence of the organisation is defeated*.

2. It is not the intention to make the above criticism with a view to detracting from the excellent work that is being done otherwise. We have made reference to these matters in the larger interests and we hope our criticism will be taken in a constructive spirit. Having considered this matter carefully, we make the following suggestions for effecting improvements in the working of the Control Board:

(1) Finance Secretaries of the two States should be *ex-officio* members of the Board. We understand that they are invited to the meetings even now but do not always attend.

(2) Some arrangements are required by which the implementation of the designs is regularly subjected to check by an independent technical agency. In this connection, attention is invited to paragraph 1.2 of Chapter III of the report. The type of arrangements that we have in mind are fully described there. We have had occasion to discuss these with the authorities concerned and we have gathered the impression that they are acceptable in general.

(3) An agricultural expert should either be made a member of the Board or should act as its consultant and adviser and should attend its meetings regularly. He should also have the discretion to make suggestions on technical and administrative aspects having a bearing on agricultural planning as it relates to or reacts on or is influenced by the process of construction. It will be the function of the agricultural expert to keep up the progress of the work consequent upon the acceptance of the proposals made by Shri Lal Singh, a member of the Team to co-ordinate the work of the Agriculture Departments of the Governments of Madhya Pradesh and Rajasthan relating to Chambal Project.

(4) The Board should set up machinery for studying questions relating to the following five functions assigned to it:—

- (i) To scrutinise the estimate of the Project prepared by the State Governments, advise necessary modifications and recommend the estimate for administrative approval of the Government concerned;
- (ii) To decide the programme of construction of different parts of the Project in the two States, keeping in view the funds available;

*The Board has since evolved a suitable procedure to eliminate

- (iii) To receive monthly progress reports both as to works and expenditure in a prescribed form from the Chief Engineers, review the progress of different units of the Project and lay down steps to be taken to expedite the work;
 - (iv) To decide the programme of resettlement of persons displaced as a result of the Chambal Project Works, scrutinise and approve the estimates of land reclamation and the expenditure incurred in resettlement and rehousing of the displaced persons including land acquisition and connected charges;
 - (v) To decide on the progressive development of water power and the withdrawals of water from the reservoir during the construction period for irrigation and power purposes with a view to securing best use of water available.
- (5) The two Chief Engineers should set up machinery for the completion of detailed estimates and for preparing Schedule of Rates. Our concrete suggestion is that a specified Executive Engineer on each project and an A.F.A. should be made jointly responsible for completing the work subject to the overall supervision of the Chief Engineers within three—six months at the most.
- (6) Subject to the completion of work at (5) above, we recommend that the Chief Engineers may be given the following larger financial and administrative delegations:—
- (i) Pending sanction to such a detailed estimate we suggested that the present limits fixed for the Chief Engineers to obtain the concurrence of the Financial Adviser should be raised from Rs. 2 lakhs to Rs. 5 lakhs in respect of sub-estimates.
 - (ii) The limit in respect of acceptance of tenders could also be raised.
- We have had opportunity to discuss this with the Finance Secretary (Expenditure) and we have been given to understand that the Union Ministry of Finance will consider these proposals sympathetically.
- (7) The agenda of the meetings of the Board should be issued a clear ten days before the meeting is due to take place.
- (8) The implementation of the above recommendations will place a greater burden on the Chairman of the Board than hitherto. This will virtually be a whole time function as it will impose both arduous and continuous supervision on the incumbent concerned.

We have deliberately avoided radical reconstitution of the Board as we understand that a separate study is being made by the I. & P. Ministry of the functioning of various types of Boards set up for managing Irrigation Projects. Secondly it would not be worthwhile, at this stage of the Project, to make changes of a nature that may lead to confusion.

3. Personnel.

Another administrative issue which is of importance relates to the staffing position on the Project. It is particularly difficult in the Madhya Pradesh area. The following causes seem to be responsible for this state of affairs:—

- (a) Experienced personnel required is admittedly in short supply and it is not a correct policy to leave each project to make its own arrangements. Sometimes this amounts to considerable competition among different projects for the same personnel.
- (b) The posts are temporary for the duration of the project or the particular item of work. It will improve the prospects of getting more experienced persons if the strength of the State Cadres was revised to include the post-project requirements so that some of the temporary incumbents could look forward to a longer term of appointment. In this connection, it is necessary that their previous length of service should count for fixing of their seniority etc., in the appropriate grade.
- (c) Even these arrangements are not likely to achieve the desired results. We are satisfied that the only solution is the pooling of existing resources to the best advantage of all the projects in the country. It involves obviously the creation of an all India Reserve of Officers who could be utilised to strengthen the projects as and when necessary. We are aware of the arguments that are given against this proposal. We do not under-estimate their cogency or importance as affecting the interests of individual states/ organisations. The necessity of creating such a reserve arises from an overall appreciation of the situation which cannot be assessed by each State. If the conditions or shortages as prevailing in Chambal are to continue it will mean severe set-back to its progress. The only real solution is that it should partake of the pooled experience of the country to the extent its priority in the scheme of planning allows. The supply of talent of this character in

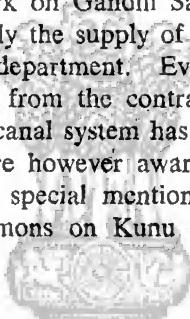
sufficient numbers is, in our view, beyond the capacity of an individual State by itself.

- (d) Another difficulty is the long time it takes to recruit personnel. Examples of this nature are given in Appendix IV to the report. Any appointment lasting over this period agreed to by each Public Service Commission for temporary posts has to undergo the procedure laid down in the respective Consultation (with Public Service Commission) Rules. This is ordinarily a long process having regard to the manner in which personnel has to be located from diverse sources in the face of competition from other organisations and projects. It is suggested that the recruitment to the project should be handled by a special committee consisting of two eminent engineers and a member of each of the Public Service Commission as Chairman alternately. The technical personnel should be recruited for as long a period as required and should be absorbed to the extent possible into the regular cadre of the State on the basis of their length of service.
- (e) Notwithstanding the above proposals, it appears necessary that development of technical personnel should proceed from within the Project also. It is understood that a scheme for training certain categories of non-gazetted establishment is already in operation at the site of the Gandhi Sagar Dam. We suggest that the Control Board should assess the long-term and short-term requirements of the Project in certain categories of personnel as also the types of existing non-gazetted establishment employed on it. The requirements and the number of such personnel should be matched and a scheme drawn up by which it should be possible to impart training for such classes of posts as are required. We are of the opinion that it should be possible to plan and devise courses of a limited character to fit the existing personnel to some of the routine tasks that will fall on the executive officers connected with the construction of the Dam, the canals, the electrical equipments for power houses and the transmission lines. After the survey suggested above has been conducted, the necessary curriculum may be drawn up in consultation with the neighbouring Universities catering for technical courses. We think that this method of development of personnel can also, with advantage, be applied to accounting and clerical staff, especially the staff needed for store-keeping and store accounting. It

should not be difficult to find retired engineering and accounts personnel, appropriate for the purpose, for imparting training theoretically as well as practically.

-4. Agencies of Construction.

4.1 A number of agencies have been mobilised for the execution of work on the Chambal Project as this is the first major work in that area and the local labour and contractors are not fully trained to take on the entire responsibility for it. The Chief Engineers had therefore to undertake the execution of the Project by means of all the agencies that could conveniently be available. For example, a considerable part of the work is being carried out departmentally. This expedient has been adopted in cases where either the quality of work justifies it or the time factor is of such importance that the work cannot be handed over to a contractor. Sometimes mixed arrangements are also made on certain items of work. For example, the masonry work on Gandhi Sagar Dam has been put out on tender. The rate covers only the supply of stones and construction and the mortar is supplied by the department. Even in this case the sand is being secured again on tender from the contractors. In order to utilise local contractors, the work on canal system has been let out on piece work. Major cross drainage works are however awarded on tender as also rock cutting and in this connection special mention may be made about the work entrusted to M/S. Gammons on Kunu Syphon which is a complicated structure.



4.2 Every effort is being made by the Chief Engineers to utilise the local labour but there are obvious limitations in this matter. In the first place, the labour is not fully trained for a complicated work of this character; secondly, there is a tendency on their part to leave the work and go back to their homes at certain seasons coinciding with agricultural operations; there is a scarcity of labour generally and therefore competitive element enters in the matter of employment as among the department, the contractors and the N.P.C.C., which sometimes leads to an undesirable mobility from one type of agency to another. Apart from the technical requirements of supervision on the Chambal Project, the situation described above relating to the various executing agencies there is a considerable amount of administrative work on the Chief Engineers, which is some-what different from the responsibilities that are carried out by such an officer on works which are executed departmentally, such as Lakkavalli, etc.

4.3 The entry of the N.P.C.C. adds another type of construction agency to those already engaged on the Projects. The following works

costing about Rs. 2½ crores have already been allotted to them on the basis of negotiations between the Project authorities and the N.P.C.C.:—

Sl. No.	Name of work	Approximate Estimated Cost (in lakhs of rupees)
1	Construction of Parwan Aqueduct on Right Main Canal. R.D. 202251 (Rajasthan territory)	32.0
2	Construction of Kalisindh Aqueduct Right Main Canal (Rajasthan territory)	43.0
3	Excavation of Right Main Canal in Mile 54-61 (Rajasthan territory)	17.9
4	Earth work in each Mile 28-29 and Mile 39 in Madhya Pradesh territory	3.0
5	Lining Work approximate 15 Miles in Mile 46 to 85 Chambal Right Main Canal in Madhya Pradesh	50.0
6	Masonry works in Mile 41-68 on Chambal Right Main Canal in Madhya Pradesh . . . Approx.	100.0
7	Rock cutting and Earthwork in Mile 48, 55, 63, 64, 65 and 82 Chambal Right Main Canal, Madhya Pradesh . . . Approx. .	2.0
TOTAL		247.9

The potentialities of the N.P.C.C. for helping the construction in areas where works on large-scale have not been carried out in the past are considerable especially when contracting resources all over the country are over-strained due to the demands of the Second Five Year Plan. If the activities of the Corporation are organised on proper basis, it is likely that they may affect the cost of construction also in the long run.

CHAPTER III—FEATURES OF DESIGN & CONSTRUCTION.

1. Constituent units of the Project.

1.1 *Gandhi Sagar Dam*.—The design takes into account the materials and labour resources that are locally available. As such the Dam has been designed in masonry using red cement mortar. Cement concrete construction has been employed in the crest and the top five feet in the ogee section of the spillway and the bucket. Special mortar mixes have been adopted both in the front and the rear at lower levels where higher stresses occur.

Use has also been made of cement concrete in the embedded structures of gate frames and penstocks.

A combination of concrete and masonry has the dual advantage of economy and efficiency.

In view of the stratified nature of the rock considerable care has been exercised in the grouting of foundations, the curtain grouting being taken to greater depths than usual.

1.2. *Kotah Barrage*.—The statement I on the following page shows the evolution of the designs of the Kotah Barrage. It has passed through six stages. In the first two stages, reliance was entirely placed on securing a complete cut-off by means of sheet piles, and a clay blanket. The blanket was 150 ft. in the first design prepared by the State and was revised to 550 ft. by C.W. & P. C. The reports available with the C. W. & P. C. at that time regarding the nature of the foundation strata showed that it consisted of boulders and sand. It was thus clear from the very beginning that there was a possibility of the sheet piles being obstructed by the boulders. It was realised in about September, 1956, that the gap likely to be left was much larger than could have been anticipated in the beginning. The designs were then drawn up to take note of this. When the Team undertook the study of the Kotah Barrage, it had before it Drg. No. IKT 57/May 57 drawn up by the C.W. & P.C. As a result of the discussions with the Consultative Committee, certain suggestions were made after careful scrutiny of the reports of the French consultants. The comments of the Team were based on the following considerations:

- (a) That clay grouting, on which reliance was placed by the C.W. & P.C. was not a foolproof method for protecting the foundations of the barrage, and
- (b) that the sheet piles having been considered to be not fully effective to fulfil the main purpose for which they were

driven, there was a necessity of thinking of other methods of protecting the foundations.

There was a number of discussions with the C. W. & P. C. after the first note was drawn up and as a result, it was agreed that the primary concern should be to establish a positive cut-off either by masonry or by concrete. It was decided that the Chief Engineer, Rajasthan would at once take such steps as were necessary for dewatering the area until 15th January, 1958, when the conditions prevailing would be examined with a view to determining whether it was possible to establish a positive cut-off either by masonry or by concrete. This examination took place on 15th January, 1958 and unanimous decision was taken vide Statement II. The final design as it was evolved is shown in Appendix V.

The Team and the Consultative Committee consider that this design * is the most satisfactory having regard to the circumstances in which the matter was found by them when they began their studies. If time schedules have to be adhered to, the work has to be programmed into its minutest details and certain amount of strengthening of personnel would be necessary for which the Team has already made suggestions.

The soundness of the Barrage structure is the crux of the entire Project as reservoirs impounding water have little meaning if the Barrage were to give way in any manner. The Team and the Consultative Committee have done their best in giving whatever constructive help and advice they could in this matter.

The history of the Barrage up-to date would appear to warrant the necessity of conducting a careful examination, at consultative level, of designs of such important structures as it is necessary that original designs should undergo an objective analysis, before being adopted and that their execution should be supervised by an authority other than that preparing them.

We are, therefore, of the opinion that projects of this nature should be provided with a body of consultants. We are of the view that enough use is not being made of retired personnel who leave service at a comparatively young age of 55. We suggest that retired Chief Engineers may be placed on a reserve list and should be given as such a proper retainer. They should be distributed over various projects and reinforced by such specialist personnel as necessary to form a Consultative Committee for each project costing more than Rs. 15 crores. They should be provided with all the necessary data and papers from time to time, their comments invited on them and taken into consideration when decisions are reached. They should also be allowed to visit the site of the work twice a year to keep

* To be read along with the decisions of 15-1-58 vide Statement II.

themselves in touch with the latest developments regarding actual construction. The scheme can be worked out in detail. Its necessity will be appreciated from the fact that in other countries all Projects undergo a thorough check at the Consultants' level. The firms of Consultants are available in the private sector. This shortcoming in the Indian conditions leads to the omission of the necessary check on designs and progress of construction. It would be observed that the C.W. & P.C. is itself, in most of the big projects, the original designing as well as the Consultants organisation. This can only be remedied by the type of suggestion that has been made above.

Our remarks above should not be construed, in any way, to reflect on the work done by the various authorities on the Chambal Project. In fact, we are suggesting that certain shortcomings in the matter of consideration of various types of issues that are likely to arise on such Projects, should be overcome by a slightly different machinery than obtaining at present. We testify to the excellent work that is being done on the Project and would like to congratulate the respective Chief Engineers on making the best of a very difficult job that they were entrusted with.

1.3 Rana Pratap Sagar Dam.—Investigations for this work have not yet been completed and no firm indications of the design are available.

1.4 Canals.—The right bank main canal passes through a rocky reach of a comparatively small length in Rajasthan, but for over 17 miles in Madhya Pradesh. The cost of lining in this reach as reported by the Chief Engineer is about Rs. 1 crore. Vide Appendix VI.

The Chief Engineer has made several studies in order to evolve the optimum section taking the economical bed width into view, with regard to the strata and heavy rock cutting involved. The reach upstream of Kunu Syphon has been studied in detail with a view to determining whether the work of lining of the bed and sides of the canals in rock-cut reaches can be simplified to a reasonable extent. The canal in this area is in rocky strata where no soil is available for construction of the banks. Hence, side walls in rubble masonry have been proposed.

After careful consideration, it can be stated that there is no alternative but to construct these side walls in rubble masonry. The specifications for this work can, however, be somewhat simplified and "chip masonry" resorted to in the interests of economy.

The bed of the canal in the rocky reaches is proposed to be lined with 4" of cement concrete and sides are proposed to be plastered with 1" thick cement mortar. With such treatment, according to the Project report, the co-efficient of rugosity may be taken as .016.

There are two objections to this proposal.

1. 1" thick cement mortar used in the shape of plaster is not likely to last long. It will certainly crack and crumble.

2. 4" layer of cement concrete over the rocky bed will need expensive construction joints and perhaps some reinforcements also.

In order to provide against excessive seepage and also to smoothen the bed, a small thickness of kankarlime concrete employing the ballast and spawls that are locally available can be used. It would be possible to obtain some soil which could be burnt into Surkhi and mixed with this concrete to ensure greater impermeability.

With this procedure, it can be ensured that the horizontal bedding joint get thoroughly caulked up with the lime concrete matrix. Subsequently, either by ramming followed by rolling or by rolling alone, it is considered possible to give the bed a degree of smoothness which will improve the co-efficient very considerably. The actual value of such coefficient will in any case not be unsafe at least for the first ten years or so, as the full extent of irrigation will develop gradually, and therefore the canal will not run full supply. Thus there will be ample opportunity for the canal being kept under watch, and any further smoothening of the bed if necessary can be secured during the closures that are expected in the operation of this canal system.

Most of the work of lining of rock-cut reaches has still to be done. The above idea thus permits simplification of the work, without in any way endangering the safety of the canal. No cement need be used for the lining of the bed or even the plastering of the sides. If the bed is treated with the lime concrete as indicated above the present canal section has ample capacity for many years to come. Thereafter further smoothening of the bed and sides can be resorted to, if at all necessary on the basis of observed full supply levels and discharging capacities. The above ideas have been discussed with Chief Engineer, Madhya Pradesh who is himself keen on making economies by the adoption of modifications on the above lines where circumstances permit. The direct economy estimated in this proposal is Rs. 15 to 20 lakhs. (Appendix VI-A).

2. Designs Organization.—Different practices obtain regarding the preparation of designs for the constituent works of the Project. The Chief Engineer, Madhya Pradesh has been obtaining his designs for all the structures connected with the Dam from the C.W. & P.C. He has referred to them until now about 120 designs out of which 101 have been supplied so far. It is the view of the Team that some of these designs, which are not of a major character, could, with advantage and convenience, be prepared by the Chief Engineer himself.

The Chief Engineer, Rajasthan is generally having the designs of all canal structures prepared by his own organisation. He has referred only the following canal works to the C.W. & P.C. for designing:—

- (i) Escape-cum-regulator where Amba Branch takes off.
- (ii) Kali Sind Aqueduct, and
- (iii) Parwan Aqueduct.

The designs of the two aqueducts have been completed and the third is still in hand. The Kotah Barrage has, however, been entirely designed by the C.W. & P.C. and all alterations and modifications to it have to be referred to them. The Team thinks that the arrangement on the Rajasthan side for this purpose is adequate and does not need any alteration.

On the Madhya Pradesh side it would be useful if a Special Designs Cell with suitable staffing is added under the Control of the Chief Engineer. A division of work could be arrived at between the C.W. & P.C. and the Special Designs Cell of the Chief Engineer by which the more complicated structures could be entrusted to the former. Any minor alterations in those designs and all the other designs which are not assigned to the C.W. & P.C. will continue to be the responsibility of the Special Designs Cell.

In order that proper liaison is established between the C.W. & P.C. and the Chief Engineers on this matter, two Designs Officers both for Rajasthan and Madhya Pradesh, may be drawn from the establishment of the C.W. & P.C., who should work under the directions of the Chief Engineers. This will have the dual advantage to the Project being afforded the opportunity of knowing the mind of the C.W. & P.C. and to the officers drawn from that organisation getting the experience of changes in designs in actual construction.

The Team is suggesting the above arrangements in order to cut short the movement of papers and of high placed personnel from the Project sites to Delhi and back for consultations on minor points which lie well within the competence of the Chief Engineers concerned. This suggestion is also being made for the reason that the C.W. & P.C. in that case, would be able to assess objectively the correctness and efficacy of the designs that are locally prepared. Thus both the elements of realism and objectivity would be introduced by the arrangements proposed above.

3. *Quality Control.*—As regards quality control, the Team observed that the necessary laboratory facilities for testing materials and for research were available at the spot.

The arrangements for ensuring quality control require to be placed on a more efficient basis. At present the responsibility for ensuring quality control rests on officers who are in administrative charge of the work. Following the principles that have been adopted on the Bhakra Project,

it would be a desirable improvement if a special Inspection and Control Organisation is created. In the first place, it will reduce the strain on engineers in administrative charge of the work and secondly, the Chief Engineers will get an objective analysis of such factors as influence quality of work. It would not be difficult for an arrangement of this character to be put into operation and if it is necessary some one from the Bhakra Project could be deputed for a short while to set up the organisation that is needed. It may be pointed out that the Chambal Project is one of the biggest Projects in terms of cost and use of materials. It is necessary that arrangements for quality control should follow scientific lines. The Team does not envisage any additional cost if such an organisation is set up as it should be possible to carve it out of the existing strength by rearrangement of duties and responsibilities. To the extent the Project is already working short, the Team has already made recommendations for addition of personnel and this work is really being transferred from one type of personnel to another type leaving the former some margin for rearrangement of duties.

4. Agency for construction of field channels.—We have given special attention to the extent of organising work of field channels. Two ways are open, namely, of getting them constructed by the villagers themselves by mobilising them and the Government undertaking the construction and recovering the cost from the villagers. The merit of the former is that it would act as a factor which would bring home to the farmers the utility of irrigation and self-help. The main drawback is that it may not be possible in that area, to enthuse them to the extent that the work may be completed in time. Having regard to all the factors especially the existing standards of agriculture as pointed out in Chapter V, later, we are definitely of the opinion that the correct course would be for field channels etc., to be constructed by the Project authorities themselves and the cost recovered later from the villagers. If this is not done, it is our view that the benefits from the Project will take long to be realised.

In order to enthuse the cultivators, it may be a desirable expedient to constitute Village Committees for purposes of co-operation with the irrigation authorities for supplying as much of the labour needed locally as possible. These are, however, matters of detail which can be worked out if an overall Committee is appointed in each Administrative Division under the Chairmanship of the Commissioner concerned of which the Superintending Engineer or the local Executive Engineer of the canal construction should be a member. The committee will undertake detailed planning for the purposes of ensuring that adequate labour supplies are available and that in the course of mobilising them the information and instructions that are necessary for the changeover from dry to wet farming, are conveyed to the villagers.

CHAPTER IV—PHASING OF PROJECT

1. Programme and Progress of Construction.

1.1 *Gandhi Sagar Dam*.—According to the Project report, the Dam was scheduled to be completed in 1959-60. The benefits from power were expected to materialize in 1958-59 and irrigation was proposed to commence in 1959-60.

The work so far done on Gandhi Sagar Dam is nearly 100 lakhs cft. of concrete and masonry out of a total quantity of 256 lakhs cft. The monthly average is 6 lakhs cft. It will thus take two years to complete the remaining work. The masonry work of the Dam is expected to be completed by June, 1959 (Appendix VII). Penstock pipes have been received and six months are required for their erection. The erection is expected to be complete by March, 1958. Originally, this work was scheduled to be completed by June, 1957, but the Suez Canal crisis has caused a delay of over 6 months.

Orders for Penstock gates have been placed by the D.G.S. & D. It is stated that two years will be needed for the receipt and installation of the gates. Thus the Dam will be ready for storage in April, 1959 as against June, 1958, which was previously envisaged.

This delay and the consequent absence of the penstock gates have been factors in setting back the storage of Gandhi Sagar. Without these gates, the dam cannot be raised to its proper heights and storage cannot be effected as flow would take place through the power station. This difficulty is now being got over by providing stop-logs for all the five penstock openings as against one opening which was originally envisaged. The extra cost of the additional stop-logs is Rs. 2 lakhs, and, in order to avoid the dislocation of the construction programme, the Chambal Control Board have approved the purchase of the additional stop-log gates (Appendix VIII).

1.2 *Kotah Barrage*.—According to the original programme, the Kotah Barrage was expected to be ready including the erection of Gates by June, 1958 and the first 80 miles of Right Main Canal in Rajasthan State by December, 1958.

In the Madhya Pradesh it is expected to complete the 1st 40 miles by December, 1958, mile 41 to 85 by December, 1959, Kunu Syphon by about the same time, mile 87 to 139 by June, 1960, and the rest of work by June, 1962.

1.3 *Canals*.—According to the present revised schedule, the first 80 miles of the Right Main Canal will be completed by December, 1958 and

in the Madhya Pradesh, the first 40 miles upto Sheopur by end of March, 1959. Only 40 per cent of the earthwork in the first 40 miles (about 9 crores cft. against 23 crores cft. total) has yet been done. Masonry works in this reach are expected to be completed by November, 1958. The expected progress of earth-work in this section is at the rate of 1 crore cft. per month. The work will thus go upto March, 1959.

From Sheopur to Kunu River, a distance of 45 miles, the reach will also be ready by the end of 1959. Now that the Kunu crossing work has been given on contract on the basis of prestressed concrete design to Messrs. Gammons Ltd., the crossing will be completed by June, 1960. The work beyond Kunu crossing has already been started and the canal is expected to be ready to feed water into the Bhind Canal system by the end of 1960. Generally, branches and distributaries are taken up simultaneously with the corresponding sections of Main Canal.

The entire canal system is expected to be completed by 1962-63.

Concentrated efforts will be needed to enable utilization of the storage supplies from 1959-60 winter onwards by the completion of distributary systems of the entire Left Canal and the Right Bank minor canals down to the Kunu syphon, by June 1960, and then right down to the Bhind area by 1960-61. For this, there is a need for acceleration of the construction programme which is considered practicable and within the resources of the Organisation in regard to machinery and equipment. Besides some direct savings it will advance the cause of food production.

2. Proposed acceleration of construction.

2.1. *Acceleration of canal construction.*—As is generally the case, the initial period of 3 to 4 years has been one of exceptional difficulties on the Chambal Project. Besides intrinsic difficulties, the peculiar circumstances of the area through which the canal system passes have presented additional difficulties. It is only now that a stage has been reached in which the works have assumed organized shape. Plant and machinery have been procured and personnel found for operating and maintaining it on a two shift basis. Labour conditions have been stabilized so that a larger number of contractors have started working at competitive rates. The alignments of channels and designs of works have also been finalized so as to ensure the work to proceed smoothly.

The tempo of work is now on the increase and will continue to be so till the end of the Project. Therefore the rate of progress of the remaining work is expected to be higher enabling its acceleration. This objective needs to be kept constantly in view. The main reasons for this are given below:—

- (a) Storage in Gandhi Sagar Reservoir is likely to be available from Monsoon, 1959. This has to be utilized without time lag if the big investment is not to remain unremunerative.

- (b) The cross-drainage works are already well started and the most complicated Kunu syphon is also now entrusted to a reliable firm, who have undertaken to finish it before 1960. While this work is being completed, the other cross drainage works can no longer be a bottle-neck.
- (c) The National Projects Construction Corporation has come into the field and the Chambal Control Board has entrusted them with a quota of work to ensure that this important organization gets a good start and also contributes towards economy and speed in the overall construction programme. Some concessions in respect of earnest money and security deposits have been very appropriately made on the ground that this corporation is a quasi-government institution. The completion of the works entrusted to this corporation is expected to fit in with the accelerated programme mentioned above.

After careful consideration and study of the quantities of work involved in the completion of the canal system in Rajasthan and Madhya Pradesh it is considered that the target date for the completion of the canal system (90 per cent to 95 per cent of the work) could be advanced provided the necessary funds are made available. We however realise the difficulty of allocating funds as it has to be done in the larger context of the Plan Expenditure as a whole.

2.2 Acceleration of Construction of Rana Pratap Sagar Dam.—The integrated development of Chambal River Valley envisages the construction of a dam 20 miles below the Gandhi Sagar Dam to be known as the Rana Pratap Sagar Dam. The original intention was to start the construction of the dam in the winter of 1957. The schedule has not been adhered to as the various preliminaries connected with the starting of construction have not been completed in time. We have ascertained that the preliminary Project report regarding the Dam has been submitted by the Chief Engineer, Rajasthan to the C. W. & P. C. for scrutiny. Certain important investigations relating to the location of the power house are however still being carried on.

The remaining investigations are in the charge of a Sub-Division under the control of the Superintending Engineer, Kotah Barrage. The Team is of the opinion that if the construction of the Dam and the power houses is to be dovetailed with the construction of the rest of the Project, it will be necessary to expedite work on the remaining investigations. The present staff, in the opinion of the Team, is inadequate for this purpose. The Team therefore suggests that a separate Division should be created directly under the Chief Engineer for finalising the remaining investigations and for work on the designs and estimates which will be taken up as a consequence

of it. This Division may be in direct contact with the C.W. & P.C. and could later on work as the designs cell for changes in designs and for preparing such minor designs as may be necessary.

The civil engineering works and installation of power plant will be the two important parts of the construction of the Dam. The situation of the Dam in close proximity to the Gandhi Sagar Dam should make it possible for pooling together of certain resources with a view to economy and efficiency (*vide Appendix X*). The conditions that arise in this connection are set out below:—

- (i) The preliminary designs of Rana Pratap Sagar Dam indicate a masonry Dam across the river bed, and an earthen bund composite with masonry facing on the right flank. The height of the Dam is 130 ft. The structure is thus smaller and less complicated than Gandhi Sagar Dam.
- (ii) The designs of power plants to be constructed at Rana Pratap Sagar Dam have not yet been finalized. Studies of the various alternatives are being made and will be finalized in the Central Water and Power Commission.
- (iii) This Dam site is situated in close proximity, just 20 miles below the Gandhi Sagar Dam, which is now more than half complete, and will be completed by June, 1959. As such a substantial portion of its construction equipment will be available for utilization on the Rana Pratap Sagar Dam. Even at present suitable plant for excavation dewatering pumps and a generating set can be spared for immediate use.
- (iv) The trained mechanics and workmen who are now handling the machines can also be switched over. Thus, a good deal of time can be saved in starting the work and attaining a tempo of progress.
- (v) The comparative quantities of excavation, masonry and concrete, involved in the two Dams show that this work can be handled concurrently with the tailing off of the Gandhi Sagar construction.
- (vi) The progress attained on the Gandhi Sagar Dam in the present stage of construction indicates that working at the same rate, the completion of the Rana Pratap Sagar Dam should not need a period of more than three years. As compared with the Project provision of doing this work in five or six years, the quicker schedule will not only be more economical but also more efficient.
- (vii) The Gandhi Sagar Dam has a works colony, which has been developed with a well equipped hospital, school and administrative offices. A good workshop and stores have also been

established. A laboratory for mortar testing is also functioning. Again, the Rana Pratap site is so easily and quickly accessible from the Gandhi Sagar colony, that elaborate buildings for Engineering and administrative personnel would not be necessary.

- (viii) All these facilities will contribute towards efficient and economical Construction of Rana Pratap Sagar Dam.

The phasing of this work will depend on:—

- (a) the necessity of installing the power plant;
- (b) availability of foreign exchange; and
- (c) the resources in man-power especially on the power side.

The Team has examined this question very carefully and has come to the conclusion that, having regard to the shortage of foreign exchange and man-power resources on the electricity side, it may not be possible for the Project authorities to spend Rs. 17.66 crores in a period of 4 years. The Team, therefore, thinks that it will be more appropriate and desirable that the civil engineering works should be completed and that the installation of the power plant may be delayed until the Third Five Year Plan. The completion of the civil engineering works earlier is being recommended on two counts:—

- (a) It will lead to economy to the extent of Rs. 54 lakhs by the utilisation of the facilities at present available at Gandhi Sagar Dam for construction; (*vide Appendix X*).
- (b) It will make it easier and expeditious later on to instal the power plant in as short a time as the schedules may allow.

The Team has, in its chapter relating to Power, dealt with the issue of power demand and utilisation in fact as during the interval from which the above recommendation flows.

3. Synchronization of stages of construction for irrigation.

As stated earlier, the programme of construction now envisages the completion of the Gandhi Sagar Dam for the first storage in the year 1959. The main canals taking off from Kotah Barrage will also be ready to a substantial degree by this date. The vital role of the Kotah Barrage for feeding the supplies into the canal requires its full completion within the time limit so that it fits in with the above programme of the Gandhi Sagar Dam and the Right and Left Canals.

The bulk of Madhya Pradesh irrigation would be possible only after the Right Bank Canal is completed upto Kunu siphon, with all the major cross drainage works.

There are two aspects which have to be separately considered for phasing of the construction in order to secure the most economical synchronization. The main point in respect of irrigation is to work out all details of the distribution channels right upto individual fields. In this respect, differentiation is necessary between:—

1. Works on canal and distributaries which have to be constructed by P.W.D.
2. The water-course system whose cost is to be borne by the agriculturists.

In regard to the work of distributaries, programmes have been drawn up for execution concurrently with the completion of sections of the main canal.

Both in the case of the Madhya Pradesh and Rajasthan States, the localization work for this purpose has just been taken up. The ground that has to be covered includes legislation required to ensure the timely construction of the water course system. We have already referred to this problem in paragraph (4) of Chapter III.



CHAPTER V—MANAGEMENT OF IRRIGATION AND UTILIZATION OF WATER

1. Close Co-operation between States and the Team at every stage.

It may be mentioned at the very outset that in dealing with the agricultural aspect of Chambal Valley Project, the Team has worked in close co-operation with the State authorities at each stage, *i.e.*, (a) studying the agricultural conditions on the spot, (b) arriving at certain conclusions on broad principles, (c) working out the details and cost of each proposal, getting the approval of State authorities, first at technical level and then administrative (Ministers) level with the result, that there has been no difference of opinion; and proposals made herein, may be considered as the result of joint discussion. The Appendices to this report give proceedings of some of the meetings held at both technical and administrative levels and broad decisions arrived at, to which reference is made at appropriate places in this report.

2. Absence of master schedule.

The first requisite of a Project of this size and nature is to prepare a master schedule interlocking the completion of various structures with a view to deriving the maximum benefit from the Project while in construction and afterwards. Apart from the master schedule, each constituent element should also be scheduled to a degree of detail that can be foreseen at the time of starting construction. If this process had been carried out, the State Governments or the Board could have easily spotted that one of the most important factors contributing to the success of the Project would be the various aspects of agricultural development consequent upon the change-over from dry to wet farming.

When the Team took over the study of the Project, it became quite clear that this aspect of the Project had not been given due attention either by the State Governments or by the Control Board. The utilisation aspect has to be interlocked and timed with various other factors contributing to the totality of the Project. It requires nearly 3-4 years if not more, before the cultivator gets ready to change over from dry to wet farming in an efficient manner. The time spent on this work, the details of which are described later in this Chapter, adds not only to the income of the cultivator but also has a bearing on the economic development of the region and the financial return on the Project. The time-lag for this work is thus a double loss to national economy.

3. Reasons for absence of master schedule.

This state of affairs on the Chambal Project may be attributed to two factors :

(a) The two States concerned lacked the necessary institutional arrangements for undertaking a job of this nature. We have already referred in the Report on Lakkavalli about a practice in the Mysore State to appoint a Development Committee consisting of engineering, agricultural, administrative and revenue experts to work out the details of utilisation as the construction proceeds. Some such machinery was clearly indicated in the two States from the very beginning of the construction but, due to a variety of reasons, and lack of experience of this type of work, a considerable delay has taken place in initiating work on the utilisation aspect of the Project. It is necessary that some such machinery should now be constituted conjointly by the two States. We would suggest the setting up of a Committee comprising representatives of both the States, with a representative from the Centre, who may be familiar with the problem of agriculture on changeover from dry to wet farming, not only to work out the details of the proposals, schemes or experiments but also to ensure their implementation without delay, supervising and modifying the schemes in their details from time to time as occasion demands and avoiding duplication of work wherever possible. As problems in both States are, more or less, common in many respects, so that the time that has been lost already may be recovered to some extent by assiduous and energetic work in this respect. In fact this suggestion of having a common board for implementing recommendations has already been welcomed by State Governments *vide* proceedings dated 11th September, 1957 Appendix XVII para. 12 and Appendix XIX & XIX-A.

(b) We have suggested some changes in the functions of the Board elsewhere to take note of these short-comings. We would suggest that this matter should receive careful thought when Control Boards are set up and their functions defined.

4. Curtailment of water utilization period.

It may be pointed out at the outset that we do not agree with the assumption in the Project Report that it should take nearly 10 years for the benefits of irrigation to be fully realised. This leisurely pace was perhaps justified in the olden days but with the progress of agricultural science and the vast experience that this country possesses of irrigation practices, it should be possible, if proper steps are taken in time, to realise the benefits from canal irrigation in not more than 4-5 years. In fact during the course of discussion by the Team, the State Agriculture Department (*vide* Appendix XIX para. 3) agreed that the period of ten years could be reduced to half if recommendations made in respect of agriculture could be implemented without delay. We are therefore proceeding on the assumption that it is

the intention that the maximum of these benefits should accrue to the cultivator within the next 4-5 years and not within 10 years as assumed by the Project authorities. It is easy to visualise the amount of economic benefit that will accrue to the country and to the agriculturists of the region if the programme of utilisation is expedited in the manner indicated above.

5. Anticipation may not be realised.

The Project authorities have calculated the food production and financial justification of the Project on the following basis :

- (a) Increased yield of 1/3 of a ton (over 9 maunds of cereals) per acre as a result of canal irrigation ;
- (b) the payment by cultivators of Rs. 8 to Rs. 25 per acre as irrigation charges; and
- (c) the payment by land owners of betterment fee of Rs. 75 per acre besides some other cesses.

It appears to us that the expectations, both in regard to food production and financial return, are not likely to be realised. An overall increase of 9 maunds per acre for all the 14 lakhs of acres under command is a noverestimate. Firstly, the whole area is not to come under grain. Secondly, at least so far as kharif food crops are concerned, there may not be any appreciable increase in food crops as there is already sufficient rainfall—30 to 35 inches. As regards the other two assumptions and expectations, (*i.e.* financial return) they can materialise *only if* cultivators find canal irrigation remunerative enough to justify payment of these dues. There is reasonable apprehension that, unless the agricultural problems referred to below are faced with vigour, the expectations and objectives are not likely to be realised in the foreseeable future. In fact, in certain areas, such as Gohad and Mehgaon Tehsils as referred to later, canal irrigation may actually prove highly injurious, within a short period unless special precautions are taken before its advent. And in this respect also, the observations of the Team find full support from State authorities in Madhya Pradesh both at technical and at Ministers' level (*vide* Appendix XV & XVII).

On the other hand, we are sure that the financial calculations made for the Project cannot only be realised but even be exceeded *if the agricultural aspect of the Project is given due attention* at the proper time which unfortunately has not been the case so far. If may, however, be stated that, after the Team had begun work on this aspect, there has been an increasing realisation that time has already been lost and special effort has to be made to recover it, at least partially, by staging a double ~~march~~ in such matters as lie within the control of human effort.

6. Problems relating to agriculture.

The problems relating to agriculture on the Chambal Project may be discussed under the following three broad headings:—

- I. The changes that are likely to occur in the pattern of agriculture on the advent of canal irrigation.
- II. Some serious problems which already exist or are likely to arise with the introduction of canal system. Unless they are immediately tackled, they would militate against the success of the canal irrigation.
- III. The steps required to be taken by the cultivator, State Governments and the Central Government for deriving maximum benefits from canal irrigation.

7. Changes in pattern of agriculture as a result of the advent of wet farming.

The background of the present pattern of agriculture would indicate the amount of effort that has to be made in familiarising cultivators with the changes that are likely to occur in future in agricultural practices.

(a) *The present pattern* of agriculture in the area is rather distressing. Although *per capita* holdings are bigger than in the rest of India, and soil is fertile, rainfall ample, yet per acre yield of crop is rather poor and the poverty is writ large everywhere. Barring a few progressive farmers, here and there, the people in general, according to the officials of Agriculture, Irrigation and Revenue Departments of Rajasthan State are said to be rather lethargic and lazy, not inclined to work until forced by starvation. Their fields are infested with *ber* bushes to an extent that can hardly be imagined. Little or no use is made of farmyard manure nor even of other elementary principles of dry farming in regard to moisture conservation, to take advantage of rains in the absence of canals. The general standard of cultivation is low. The seed rate is 40-50 seers of wheat per acre (double of that in the Punjab) but the recovery is only 4-5 maunds or so per acre according to reports of Agriculture Department. The yields of other crops are likewise low *i.e.* cotton about two mds. per acre under dry condition, maize 6-8 mds. (unirrigated) and 12-14 mds. (irrigated); only 800 acres are devoted to sugarcane in Kotah and Bundi Districts (Rajasthan) and cotton occupies hardly one per cent of the total area. The conditions in Bhind and Morena Districts of Madhya Pradesh coming under Chambal Project, appear to be no better than that in Rajasthan except for a few progressive farmers, which shows the possibilities with proper investment and guidance.

(b) *Future pattern*.—That canal irrigation must bring about revolutionary change in the pattern of agriculture, needs no emphasis. Irrigation should induce people to make greater use of farm-yard manure which at present is largely wasted. Composting, or even green manuring practices, to maintain the fertility of soil, now almost unknown, are bound to get

popular. Even in a big town like Kotah, thousands of tons of town refuse, animal dung, human excreta and rubbish are all used in filling depressions in the town. All this must change when canal irrigation will demand greater use of such materials. In regard to dairying or animal husbandry, the two biggest factors in yield of milk, are good breeding and good feeding. There being no green fodder at present, it is a pitiable sight to see scores of stray cattle, particularly cows, roaming about in the town even at midday, eating garbage or human excreta, papers, rags, card-boards, just anything to fill their stomach. No wonder that yield of milk per cow is hardly a few ounces each. Canal irrigation should make available any quantity of green fodders like berseem, senji etc., which must improve milk yields of milch animals. Cotton, now occupying an insignificant area, is bound to increase greatly, provided, of course the State Agriculture Departments are able to determine varieties of cotton, best suited to the local conditions, and the best agricultural practices under irrigation, and to popularise the same. Areas under fruits, vegetables, potatoes, ground-nuts and other garden and cash crops are bound to expand greatly. Fruit growing and sugar cane cultivation have the greatest possible scope, and because of their immense potentialities, separate paragraphs have been devoted to these two subjects later.

(c) *The rotation of crops* in future is another important issue. It was observed, as was natural, that a considerable difference of opinion exists between the Agriculture and Irrigation Officers. A detailed discussion appears to be necessary to get reasonably accurate idea of the rotations likely to be followed in future. It is, however, clear that people will grow crops which they will find most profitable under irrigation condition, and this in turn, will depend upon the ability or capacity of the State Agriculture Department to solve particular problems of the cultivators under altered conditions. People do not hesitate to take up any crop on a large scale if it pays. There are instances where, due to installation of sugar mills, the area under sugarcane went up beyond expectations, and at other places, due to low price, some crops have almost completely disappeared. On the other hand, in a place like Samrala in the Punjab, where ground-nut was almost unknown only a short time back, it is now almost a dominant crop for miles and miles at a stretch; so that the future pattern of agriculture, and rotation of crops will change, to the extent, that Agriculture Department is able to undertake experiments and trials to serve the interests of the farmer. The possibilities are so immense that if a resolute, determined and scientific effort is made, there would be a revolution in the economic development of the area.

8. Serious problems that require to be tackled before the advent of canal irrigation.

(i) G. C. A. & C. C. A.

As is the general practice, the canal authorities (in calculating Gross C. A. and C. C. A.) have depended upon revenue figures and Survey of

India Reports. On the basis of levels indicated in Survey of India, all the lands that can be commanded by canals are included in Gross C. A. and out of these areas, lands which are now under cultivation (or under crops as shown in the revenue record) are included in C. C. A. along with half of the area of present waste lands, with levels which can permit canal irrigation. Ordinarily there could be no objection to this calculation. But the actual observations on the spot show that in certain localities such as Borod, Etawah, Pipalda in Rajasthan, there are extensive areas of lands, which are under crops at present and hence included in C. C. A. but where irrigation will be risky if not dangerous, and in some places extremely difficult, if not impossible, without a great deal of preparatory work involving heavy expenditure. In fact in one extreme case viz. Borod to Etawah detailed enquiry vide sheet No. R8(B), showed that out of 4636 acres under cultivation, of which no less than 2574 or 68 per cent. of the cultivated area requires levelling.

It seems therefore necessary to find out the extent of difference between (a) figures of C. C. A. as taken at present by the Irrigation authorities and (b) the actual position on the spot. This can be done in several ways, such as, either by carrying out sample survey of certain representative area. Better still the figures of Irrigation Department can be reconciled with the figures of Agricultural Chemist Rajasthan who has carried out intensive soil survey and has marked out areas which are capable of irrigation, on the basis of topography and soil conditions etc. and necessary water allowance should be reconsidered in certain areas. This enquiry in fact, has already been agreed to *vide* proceedings of meeting dated September 15, 1957.

(ii) Water allowance:

In both Rajasthan and Madhya Pradesh, water allowance in Chambal Valley Project, has been calculated at the rate of 6 cusecs per thousand acres at the head, 5.5 cusecs per thousand acres for areas 30000 acres and above, 5 cusecs for areas between 15,000 to 30,000 acres 4.5 cusecs for areas between 5,000 to 15,000 acres and 4 cusecs per 1,000 acres for areas upto 5,000 acres. Considering that,

- (a) whole of the area coming under Chambal Project in Rajasthan and some area in Madhya Pradesh has 30" to 35" annual rain fall;
- (b) there are compact areas like Digod Tehsil in Rajasthan and Gohad and Mehgaon Tehsils in Madhya Pradesh (with a total area of 7 lakh acres, 1.4 lakh acres and 1.2 lakh acres respectively or a total of 3.3 lakh acres in above Tehsils coming under irrigation) where in places sub-soil water already rises to dangerous level in Monsoon, and where it will be risky to give normal water allowance without hastening waterlogging and

(c) in certain areas, as already referred to above, the lands are highly uneven where it will not be possible to profitably utilise the water allowed for. The water allowance provided in those areas where the above conditions are evident, should be reexamined. The surplus water, if any, can be utilised either to extend the benefit of irrigation to new area or to utilize the same in certain specified areas, in a manner as to secure maximum advantage from the same. For instance, it has been agreed by both the States to have "Sugarcane Belts" where cane cultivation may be concentrated and this will naturally require much larger supply of water per thousand areas of sugarcane land than other farm crops do ; and, accordingly, the size of minors (or perhaps even distributaries) would have to be adjusted to suit the cropping pattern.

9. Salt contents of water and water tables in the percolation wells, and danger of water-logging in some areas.

(i) The perusal of the data supplied by the Agricultural Chemist, Rajasthan, in regard to (a) salt contents of well water (Total soluble solids T.S.S.) and (b) water level in the wells, brings to light some important points. In the Right Main Canal Area of Rajasthan called Block No. I, water samples from 185 wells, out of about 1000 wells in the area, were analysed. Out of these, 139 wells were found to contain T.S.S. below 1500 P.P.M. (parts per million) which is a safe limit; 24 wells, between 1500 to 2000 P.P.M., 22 wells contained above 2000 P.P.M. and in some cases T.S.S. was as high as 6320 P.P.M. It may be added that 185 wells form only about 20 per cent of the total number of wells in the area, the water of remaining 80 per cent of wells could not be analysed for want of staff. In order to have clearer picture of the present position, the Team wanted analysis of water of at least 50 per cent of the existing wells and it is gratifying that Agricultural Chemist who was asked by the State to complete this work with least delay has since completed the same and confirmed these apprehensions (*vide* proceedings Appendix XX-A, Para 1).

(ii) *Digod Tehsil worst affected.*—Although wells containing 1500 to 2000 or even 2000 to 6000 T.S.S. per million parts are scattered all over the commanded area (on the basis of analysis of only 20 per cent of the wells) but wells with high salt content and shallow sub-soil water table, are mostly found in Digod Tehsil, District Kotah, bounded in the South, from Choti Polai to Bamori, in the East, between Bamori and Amar Paul, in the North, from Amar Paul to Udpura via Turan to Kcholia to Udpura, and in the West, from Udpura to Naya Gaun to Choti Polai to Kararia. The total affected area, in this locality alone, aggregates to roughly 20,000 acres. This area is situated more or less in the middle of the South of the commanded area of Digod Tehsil with Digod more or less in the Centre.

(iii) *Water table.*—Water table in some of the wells in this area (Digod Tehsil) in the Monsoon Season comes upto 10' from the surface and in a few cases upto 4'-5'. Even in places, other than Digod area, the water level rises up in Monsoon to a dangerous level. For instance, at Mandana and Dhakar Kheri in Lodpura Tehsil, sub-soil water level in the wells comes upto almost surface of the ground. Likewise in Sunwasa and Leserda in the *Left side* of the canal in Talaria Tehsil, the water level in the wells rises upto 3' from ground level and in Lodpura, Bindia, Jaloda, Arneta, Naya Gaun, Haripura, Kapren, Charna and Banjarli, over an area of 20 miles, the water level comes upto 3' to 6', in Monsoon Season. With the advent of canal irrigation, there is likely to be a serious danger of the soils getting water-logged. Even on the East Side of the commanded area, there are many places where water level comes upto anything like 4' to 10' from ground surface and in some cases up to ground level.

(iv) *Madhya Pradesh.*—On the Madhya Pradesh side of the commanded area also, there are certain localities which have rather disquieting features. Certain amount of preliminary work was done by Dr. C. L. Dhawan of the Punjab Irrigation Research Station, Amritsar, which has been continued by the Agricultural Chemist, Madhya Pradesh, with headquarters at Gwalior. The position, briefly, is that while many areas are free from any serious danger, there are several localities fairly big in areas (Gohad Tehsil alone with an area of about 1.5 lakh acres) which are already confronted or are likely to be confronted (as soon as perennial canal water becomes available) with the problem of alkalinity and water logging. In Morena District, Tehsil Sabalgarh, Village Sami and in Tehsil Jora, Village Samauli, soils are said to have both high total salts (above 2000 P.P.M.) and high P.H. value upto 10 ft. depth; in Bhind District, Village Mehgaon, Mehgaon Tehsil, sub-soil water is said to contain as much as 519 P.P.M. of Sodium-bicarbonate alone which is bad for crops and sub-soil water table in Mehgaon ranges from 3½ ft. to 17 ft. even in the dry month of the year. Perhaps, the worst case is that of Gohad Tehsil (Bhind District) where no less than 1.5 lakh acres are to receive perennial irrigation from Chambal Project while they are getting water now only from seasonal canal. According to Dr. Dhawan, he had found even in February, 1952, i.e., in dry part of the year, water table ranging from 3½ to 17 ft. such as Chadokar 6 ft., Chak Rahitpur 8.5 ft., Sherpur 10 ft. Village Bora Head 3½ ft., Tueda 7½ ft., Mallanpur, Kiratpur and Gorikho 12-13 ft. During the visit of the Team to Gohad Tehsil, accompanied by Deputy Director, Agriculture and District Agricultural Officer, the water table in the well at Gohad proper was found to be about 15 ft. and this month (June) was the driest part of the year. All the people who met the Team, as also the Agricultural Officers, stated that water in the wells in Monsoon Season does come upto ground surface. The Team itself could see, even then incrustation of salts on ground surface and soil analysis shows T.S.S. as high as 6000 P.P.M. in some places against about 1500 P.M.M. beyond

which it become risky to cultivate. There is already what is called "soil sickness" prevailing in the whole Tehsil.

(v) It is a fact that, irrigating 1½ lakh acres in Gohad Tehsil with proposed perennial irrigation system, cannot be free from anxiety particularly in view of (a) fairly heavy annual rainfall of 30" to 35" (b) water table in soils already rising to ground surface in Summer (c) high Ph value or high T.S.S. (d) soil sickness already prevailing. It seems difficult to believe that in the long run, the proposed canal irrigation unless special precautions are immediately taken, would prove anything but a curse for this area, especially as cultivators, in their anxiety to get water for Rabi crops, are likely to think only of their short-term interest.

10. Steps to prevent water-logging, salinity, bad drainage etc.

(i) Having invited particular attention of the State authorities to (a) the appearance of salts or alkali on soil surface and high salt contents in some percolation wells (b) subsoil water in wells rising to a dangerous level in Monsoon Season even at this time and (c) the danger of groundwater level rising still higher with the advent of perennial canals, (d) lack of drainage in some areas, resulting in definite danger of water-logging, the Team also suggested to the State Authorities that in the event of their agreeing with the above observations, it would be highly desirable to take some steps such as (i) lining a portion of the canal or distributaries, minors or even main channels to prevent seepage of canal water in certain areas highly susceptible to water-logging and alkilineity like Gohad Tehsil in Madhya Pradesh and Digod Tehsil in Rajasthan (ii) providing satisfactory drainage system (iii) installation of tubewells (provided suitable sub-strata i.e., water bearing strata be available) (iv) encouraging the use of pumping sets in open wells which, besides supplying water for irrigation, would also help in keeping down sub-soil water level, (v) reducing or stopping the supply of canal water to growers in this area or/and to supply water from tubewells, (vi) avoiding accumulation of salts by proper cultural practices especially in areas which are already showing salt patches and (vii) study of sub-soil conditions to determine the salt contents of sub-soil, the nature of sub-soil i.e., whether pervious or impervious etc.

(ii) In this connection reference may be made to (Appendix No. XV paras III & IV) of the proceedings of the meeting held at Bhopal at Ministers' level which reads "there was general agreement on all the recommendations made in Sardar Lal Singh's report. It was agreed unanimously that the economic success of Chambal Valley Project will depend upon the extent to which the agricultural problems referred to in the report, are solved. Unless precautions are taken to avoid the anticipated danger and experimental work is done to find answers to the questions that will arise with the advent of canal irrigation, the canal irrigation may not prove as beneficial a proposition as expected and may

in fact even prove a curse in certain areas by bringing about water-logging or creating alkalinity problems or hastening soil erosion".

Subsequently in another meeting held at Bhopal at Ministers' level on September 11, 1957 (*vide Appendix XVII*) the "Chief Engineer (Irrigation) was asked to examine the problem in Gohad and Mehgaon Areas and to submit the report within a month stating the measures to be adopted and it was further agreed that the canal and drainage programme in the whole Chambal Project area should go hand in hand and the Chief Engineer (Chambal) will take necessary action".

(iii) As a result of these decisions, the Chief Engineer (Irrigation) and also Chief Engineer (Chambal) made a thorough survey of Gohad and Mehgaon Tehsils and their reports are reproduced in Appendix XVIII. The Chief Engineer states "to my mind there appears to be a case of absolute lack of drainage facilities.... it is absolutely essential to have a suitably laid out drainage system to dispose of rain water and the seepage water. Shri Char and I have agreed that ample provision will be made in the proposal for re-modelling Bhind to provide an elaborate drainage system". They also agreed that a record of spring level in the wells should be maintained and reported twice a year—once before the Monsoon in May and again after Monsoon in October; and further sub-soil conditions upto 10' depth in Gohad and Mehgaon areas, (M.P.), may also be studied with a view to ascertain the nature of the soil contents with particular reference to the presence of salts and the perviousness as related to underground drainage. The report of the Deputy Chief Engineer goes into greater details. He, not only agrees with all the observations and the methods suggested by the Team, but refers to villages worst affected by the stagnant water pools, rain and canal water, and he suggests that this could be drained off by artificial drain leading to Basely River. He also confirms that water level in the wells in some places even at this stage is 3' to 5' below ground level and he refers to places where rain water from the fields is not drained off for days together and some cultivators drain out the water by breaching seasonal canals which shows the gravity of the problem, as these areas will be coming under perennial canals which must increase the evil.

(iv) The Team has been requesting Rajasthan State Authorities to expedite the preparation of the estimates of expenditure involved in providing drainage etc and the Chief Engineer, Shri Char, has recently informed the Team verbally that, while detailed estimates will be forthcoming after a month or so, the expenditure on drainage system in Gohad Tehsil and for lining a small portion of canal, would roughly come to about rupees ten lakhs. Secondly, the question of estimates of sinking tube-wells can only be taken up when the feasibility of sinking the same i.e. the condition of sub-strata and availability of water are first ascertained by exploratory tubewells and this must naturally take some time.

(v) The Deputy Chief Engineer in his report has also referred to the practice of manufacturing salts by villagers in some of the saline spots in the area. This being so i.e. salt contents being so high, it is obvious that, with the advent of canal system, crop production and cultivation practices will have to be carefully planned out to avoid serious consequences of soils getting salined. As a result of large scale experiments conducted in West Punjab, the usual practice of reclaiming saline areas has been to grow paddy, firstly, because it is fairly resistant to salt and secondly, excess water in the soil minimises concentration of salts and thirdly, heavy irrigation tends to force down the salts very deep beyond the reach of the roots of crop and thereby become comparatively harmless. While this is a good practice to recommend, but under certain conditions of inadequate drainage it can also hasten water-logging. These are, however, matters that will have to be kept in view by Irrigation and Agriculture Departments, working in close collaboration and encouraging desirable agricultural practices on the part of the cultivators.

11. Irrigation and land development.

(i) Without proper levelling of land or even terracing in some extreme cases, canal irrigation is likely to do more harm than good, in as much as, the crops at high level will die for lack of moisture, and that in the depression, suffer due to excessive moisture. Uneven nature of soil in rainfed area is not of such a serious consequence as in irrigated areas. The lands both in Madhya Pradesh and Rajasthan coming under Chambal Valley Project in many places are highly uneven and of undulating nature and an extreme example of Etawah, Borod and Pipalad in Rajasthan has been cited elsewhere, with two thirds of cultivable area being uneven, it is desirable to level such lands in a manner that would make canal irrigation most fruitful. Proper levelling would increase the productivity of land and enable the cultivators to gladly pay irrigation charges and also betterment fee. In the absence of this levelling, irrigation may not produce such good results and may not increase crop yields and this in turn, may discourage the farmers to pay even irrigation charges, and more so, the betterment fee. Further, in the absence of levelling, there will be immense wastage of canal water which will be a great national loss, leaving alone the deterioration of land as a result of soil erosion.

(ii) The alternatives suggested are:—

- (a) The State Agriculture Department may undertake this work on the same lines as is being done at present in other parts of the State by State Tractors.
- (b) C.T.O. may be asked to undertake this work if they can spare their existing tractors and equipment for this purpose.
- (c) Private agency may also be induced to undertake this work which will mean that the State will not have to incur much

expenditure in the beginning, but will only serve as an agency to get the work completed by private agency, on behalf of the cultivators, and the State will pay the charges to private agency and recover the same from the cultivators as in (a). In some cases even the cultivators may themselves be able to get it done by hand worked scrapers drawn by bullocks, if loans are given to them for this purpose.

(d) A portion of the work be got done through private agency and a portion through Governmental agency—both of them serving as counter check on the comparative efficiency and economy of one another; and at the same time, initial capital expenditure could also be curtailed.

(iii) Whatever methods are adopted, expenditure will have to be provided. This will, however, be more of a loan than subsidy, although possibility of incurring some loss cannot be ruled out. According to detailed estimates, the area requiring levelling will be of the order of 15 to 20 per cent i.e. a lakh or lakh and a half acres in each State and it is estimated that cost per acre may vary anything from Rs. 20 to 50 or an average of Rs. 35 per acre. Madhya Pradesh Government have already got some fleets of tractors, working in areas other than Chambal, which, however, cannot be spared, as they have more work than they can cope with. They are working on 'no profit no loss basis' on private people's lands—clearing jungles, levelling lands, making bunds etc. etc. The State Government agree with the Team on the necessity of levelling the land in Chambal area through one agency or another, as referred to above. The Team in consultation with State Agriculture Department on the basis of past experience of this State has made a provision of Rs. 34·5 lakhs in the first year and Rs. 6·8 lakhs per year in subsequent four years, the cost to be recovered by instalments from cultivators. Rajasthan Government, likewise, agree on the necessity of getting this work done and necessary provision of Rs. 30 lakhs has been made, but the exact manner in which the work is proposed to be done, yet remains to be decided. This, however, should make no difference *so long* as the necessity of work is agreed to and funds provided, regardless of the manner in which the work is to be undertaken in different areas to suit local conditions.

12. Wild ber bushes—a serious pest and some suggestions for its eradication.

(i) The Team hardly came across any area in Rajasthan which was not, more or less, infested with wild *ber* bushes. Some of the fields were infested to an extent that hardly a foot of land was available for growing crops. The extent of infestation varied from 10 to 100 per cent. Not only does this pest occupy the land which would otherwise be available to crops, but it also robs the soil of its moisture and plant nutrients which

could be utilized by the standing crop besides making all culturable operations difficult and expensive.

(ii) This pest is almost equally bad in Madhya Pradesh, except here and there, where cultivators are keeping it in check. According to the estimate of the Deputy Director of Agriculture, Madhya Pradesh (Shri Bhargava) an increase of 3 mds. of grain per acre on an average could be expected for the State as a whole if this pest could be removed. The Agricultural Chemist of Rajasthan calculated, for the State as a whole, that the area physically occupied by *ber* bushes (making impossible for crops to grow) would be of the order of 15%. On the basis of areas visited by the Team, this estimate is very much on the low side but even the loss of 2 to 3 mds. per acre per year, for the State as a whole, involving loss of several crores of rupees per year on account of these pernicious bushes, is one that deserves serious consideration.

(iii) As regards its eradication, various suggestions were forthcoming—some persons taking it lightly that with the advent of canal irrigation requiring constant cultivation, this pest will automatically disappear in due course. The concensus of opinion however was, that some solid step will have to be taken to eradicate it if full benefit of canal water was to be realised. One suggestion was that Government should get the land ploughed up by tractors (through Government tractors or privately owned tractors undertaking this work on contract basis) and recover the cost from the growers in 5 years by instalments. The suggestion given by the Commissioner of Kotah was, to issue notices to the cultivators to free their lands of this pernicious bush by the time, the canal water becomes available, failing which, the cultivators will not get water but will have to pay the irrigation charges just the same. This warning, coupled with provision of necessary facilities by Government for tractor ploughing, should force the cultivators to either eradicate *ber* bushes with their own efforts or to secure help from the Government in its eradication.

(iv) At the suggestion of the Team the Agricultural Departments of the two States have undertaken to study the comparative costs of the various measures and to suggest the best possible measures for the speedy eradication of this pest, including trial of destruction of this pest by chemicals, if found economical and practicable for large scale adoption.

13. Kankar layers—its problems.

Numerous soil samples taken by the Agricultural Chemist Rajasthan show that while some soils in the area under Chambal Project are absolutely free from kankar layer upto a depth of 6', there are numerous areas where kankar layer does appear at varying depths—anything from 2' to 4'. Kankar layer, if devoid of a degree of admixture of soil, can prove exceedingly harmful. If it is too porous, then excess amount of irrigation water applied will not only be wasted but it will wash down the soil nutrients from upper surface soil to a depth beyond the reach of roots.

On the other hand, if kankar layer is impermeable, then also, excess amount of irrigation water applied, will create conditions prejudicial to the healthy growth of plants. Under both conditions, the best practice will be light irrigation but at more frequent intervals, to get best results.

Further it is difficult to predict at present whether (a) heavy continued application of canal water would help in disintegrating the kankar layer and enabling roots of crops and trees to penetrate through the same or (b) it will have quite the reverse effect of making these kankar layers impervious. Since kankar layers are met with, over very large areas of Chambal Valley Project in Rajasthan, this problem deserves to be investigated immediately.

14. Hard Pan.

Soil survey carried out by the Agricultural Chemist shows the existence of hard pan in several localities which may interfere with the penetration of irrigation water and roots of crops and trees. This deserves to be looked into immediately, so that if hard pan be really of such a serious nature, steps could be taken to break it with the help of mechanical implements which are available with most of the tractor-dealers. Apart from making observations on the penetration of water and roots on lands under-laid with hard pan, some lands belonging to private cultivators having this hard pan, could be selected and demonstration carried out on two adjoining fields—one in which hard pan remains undisturbed and the other in which it is broken by the implements, and to compare the relative growth of crops in both the fields. This simple experiment would prove and demonstrate the seriousness, or otherwise, of the problem of hard pan, and the extent to which it requires to be tackled. If it is found serious, necessary propaganda will have to be conducted to educate the farmers.

15. The task ahead—important problems.

(i) In addition to the problems, already discussed, namely G.C.A. and C.C.A., danger of water logging and salinity, wild *ber* bushes, kankar layer and hard pan etc. which need to be tackled, we may emphasize that the advent of canal irrigation will bring about radical changes, not only in the type of crops grown but also in the pattern of farming which will have tremendous effect on the income of the farmer and on canal revenue. It is therefore, urgent that experiments should be initiated at once to find answers to some of the elementary, but fundamental questions that are likely to be asked by the farmers on the changeover from dry to wet farming. These may be summarised below:—

- (a) Varieties of crops best suited under irrigation conditions.
- (b) Cultural practices under irrigation conditions, time of sowing, seed rate etc.

(c) Manurial requirements.

(d) Intensity of irrigation or water requirements of crops and the manner of irrigation having regard to the nature of soils and crops.

(ii) These are only some of the problems listed illustratively. In fact, some of the items referred to above such as varieties, seed-rate and time of sowing may look very trivial but it would be wrong to under-estimate their substantial effect on the yields of crops. For instance, in the area now coming under Chambal Valley Project in Rajasthan and Madhya Pradesh, a seed-rate of 50 seers per acre and sowing of cotton in July, are common practices and people have little knowledge of the varieties of wheat, cotton, rice and other crops best suited under different conditions of soil and irrigation. As against the above practices, it would be of interest to mention that in recent experiments by I.C.A.R. at Nasirpur near Patiala (Punjab) on a land previously farmed under *rain-fed* condition and now coming under canal irrigation, it was observed that a delay of even 10-15 days in sowing wheat, resulted in fall of production of as much as 3 mds. of wheat per acre; and in trial of seed-rates of wheat (i.e. 25 seers, 35 seers and 45 seers per acre), the seed-rate of 25 seers gave best results. At other places, in cotton experiments early sowing (April-May) gave more than 100% higher yield than late sowing (July) and in varietal experiments, difference in yield in case of different *varieties* of wheat under *identical* conditions was as high as 10 mds. per acre. In short in States, possessing well developed Agriculture Departments, the cultivators are in a position to receive sound advice in regard to cultural practices and varieties best suited under different conditions of soil fertility and irrigation water etc. But the Agriculture Departments of the two States due to inadequate staff and lack of experimental data are not yet in a position to render reliable and satisfactory advice. Importance of authentic advice cannot be exaggerated, if we are to make the best use of canal facilities.

(iii) The Team got the impression that a considerable leeway had to be made in organizing the Departments of Agriculture both in Madhya Pradesh and Rajasthan. To some extent, lack of preparedness could be attributed to the manner in which the States came in existence, as a result of merger of small princely States, which from the very nature of things could hardly be expected to do any great deal of research work for want of funds and adequate staff. The Team understands that the research stations are being established, staff being appointed, and laboratories are being fitted out, although unfortunately some of the Research Officers have had practically nothing to do for a long time for want of laboratory facilities. Still more unfortunate is the fact that, in order to satisfy the local political claims of the capitals of erstwhile Princely States, the headquarters of experts of various branches in agriculture, are being located in various cities all over the States which would hardly be conducive to proper co-ordination of

scientific work. For instance, crop breeder must have constant co-operation of pathologist, entomologist and agronomist in producing disease-resistant or otherwise suitable varieties of crops. Likewise, the agronomist, agricultural chemist and statistician, must have the co-operation of one another, to statistically interpret or analyse the results of manurial, varietal or cultural experiments. And it is inconceivable that experts in different branches, sitting far apart at different places, can really contribute their best to the solution of problems.

(iv) What requires to be emphasised is that, next to Bombay with an area of 1·8 million sq. miles, Rajasthan and Madhya Pradesh are the two biggest States with an area of 1·7 and 1·6 million sq. miles respectively. And apart from their size, because of their backwardness in agriculture, they will have enormous number of agricultural problems to tackle, and that also, in the shortest possible time, in order to get the proper benefit from facilities that are being made available through Chambal. Since both the States are now setting up a number of agricultural colleges and research stations, they should take care to establish high traditions, and it is, necessary that petty and/or local considerations should not be allowed to affect adversely the larger interests of agricultural industry of the States.

(v) Leaving this apart, it would, in any case, be necessary to organize separately in *advance* of the proper organization of the two Departments of Agriculture, the work that has to be undertaken in the Chambal Valley for agriculture development, consequent upon the availability of water.

16. Other important problems.

The following specific problems need almost as much attention as those referred to above if irrigation facilities have to yield the best results:—

- (a) There is a possibility of development of horticulture and sugar industries on a large scale.
- (b) Certain incidental problems such as popularizing green manuring, composting town refuse, consolidation of land holdings, future of village tanks, development of new villages and towns, communications, *warabandi* or water turn, eradication of malaria, would need careful planning before the problems created by them overwhelm those in charge of administration.
- (c) Certain decision will have to be taken regarding the types of institutions that should be encouraged for successful farming.

A detailed description of the problems arising under each head is attempted below:—

17. Horticulture industry.

Horticulture can bring about revolutionary change in the agricultural economy of the two States. The possibilities would be realised from the

fact that California, with a population of only a fraction of that in Rajasthan, has over two million acres under fruits bringing an income of hundreds of crores of rupees. Even though the area under fruit at present in the two States is insignificant, yet the presence of a good number of fruit trees of many kinds—mangoes, citrus, papaya etc., flourishing in many places bearing fruits of excellent quality, indicate remarkable scope for this industry. Bunches on some orange trees were seen carrying two dozen fruits each, and some Kagzi lime plants were stated to yield as much as five maunds of fruits each and likewise some mango trees in both States were seen bearing profuse crop. Papaya plants in one garden were seen laden with fruits of excellent quality and expected to yield an income of over two thousand rupees per acre—all this because of fertile soil, abundant supply of water and suitable climate free from frost. Protective foods have to be encouraged in India in the interest of health and it is doubtful if the price of fruit would be unremunerative within any foreseeable future. There is thus an enormous scope in both States for establishment of a really first class horticulture industry, followed by fruit and vegetable preservation industry. What is needed is "mass scale production" of nursery plants of *reliable* varieties for supply to public on "no profit no loss basis". The gardens of the erstwhile rulers, such as of His Highness the Maharaja of Kotah, can play a valuable role by supplying, at a reasonable price, budwood from high quality fruit trees growing in their gardens. It is therefore suggested that immediate survey should be undertaken to locate trees of outstanding merit in private and Government gardens from which budwood can be taken for mass scale production of nursery plants of pedigree stock, thereby laying the foundation of fruit industry in the two States on a most scientific basis. It will be a pity to allow fruit industry to grow haphazardly.

18. Sugar industry.

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(i) *Sugar Industry*, also like horticulture, offers immense scope. In the presence of two biggest factors *i.e.* plentiful supply of water and fertilizer and the absence of severe frost, there is no limit to yield of cane in fact, cultivators in some places in India are already getting as much as 1500 mds. cane per acre as against an average of 300 mds. for India. Hirachand Walchand Farm in Bombay State gave in one year highest yield in the world—exceeding 3000 mds. per acre. In order to get required quantity of water, cultivators in Bombay State do not mind paying irrigation charges as high as 100 to 120 rupees per acre per crop. Due to abundant supply of canal water and much greater "water allowance" in the proposed canal area than in other States, there is no danger of water shortage nor of fertilizer, both artificial and organic, and there is also little fear of frost and all these factors can greatly contribute to very high yield of cane per acre.

(ii) *Most desirable course will be to earmark certain areas as "Cane Belts" where cane cultivation may be concentrated with due regard to*

soil, water conditions and other factors. It will also lead to improvement in quality of cane, as the two biggest factors in "Recovery of sugar from cane" are (a) time-lag between cutting of cane in the fields and its crushing in the mills *i.e.* shorter the period, greater the recovery (b) correct ripeness of cane when cane is crushed, besides, of course, suitable varieties and good culturable practices. Since all these factors can be fully and readily controlled if cane cultivation is concentrated in certain areas; we can expect these "Cane Belts" to give not only very high yield of cane but also very high recovery of sugar. In Rajasthan and Madhya Pradesh, we can aspire to create Cuba and Hawaii which are so famous for their sugar industry.

(iii) Area under cane in Rajasthan and Madhya Pradesh at present is insignificant *i.e.* about 65,000 acres and 75,000 acres respectively as against about four and a half lakh acres in Punjab which in size is hardly one third of Madhya Pradesh, and over three lakh acres under cane with about thirty sugar mills in Bihar. Not only have Rajasthan and Madhya Pradesh got good scope for sugarcane production but each of these States is bigger in size than even U.P. which alone has got over thirty lakh acres under sugarcane and 68 sugar mills. Even quarter of this area under sugarcane in Rajasthan and Madhya Pradesh, with quarter the number of sugar mills, can bring about remarkable prosperity to the cultivators, the State Governments and public at large.

19. Farm-yard manure, composting and green manuring.

The practice of storing farm-yard manure in pits, green manuring in fields and composting refuse in towns, are almost unknown in most areas which are to come under Chambal Valley Project, so much so, that even in a town like Kotah (Rajasthan) city sweepings, animal dung, rubbish and human excreta, are all used in filling depressions in the city which is a criminal waste of valuable material. The Town Committees may have to be given loans as done in other areas. In order to popularise the practice of green manuring, green manure crops may have to be exempted from irrigation charges as done in Punjab provided the crop is ploughed under before certain date. The Team is glad to report that both the States have agreed to this suggestion. Propaganda or Legislation (as in Punjab) may be necessary to ensure storage of farm-yard manure in pits, so that their useful ingredients are not lost by rain water, sun heat or wind. The State authorities agree that they would take necessary steps in this direction, but no special financial provision need be made for this purpose.

20. Consolidation of land holdings.

It is obvious that consolidation of land holdings before canal water becomes available, would greatly help in better and more profitable utilisation of canal water and in fixing *Warabandi i.e.* allotment of water turn to individual cultivators. The State authorities have agreed that the Chambal Valley area may be given priority over other areas in executing their land consolidation programme in the State (*vide Appendix 17.*)

21. Village tanks and their use.

A very large number of big village tanks, (which formerly prevented soil erosion and stored water for irrigation) are now going out of use and their utility in future may be thought out. With the advent of canal irrigation they can still be put to good many uses like "Fish Tanks" to rear fish which has proved such a paying proposition in many States or for production of crops like *Sangara* or as insurance against periodic closure of canals for short periods. Since with the advent of canals, there will be little danger of these big village-tanks to dry up, a well thought out plan by the Fisheries Adviser to Government of India can augment fish resources immensely.

22. New village.

In canal irrigated areas, residential houses have got to be as near the fields as possible, other-wise canal irrigation has little meaning. Accordingly many new villages are bound to arise and this will also lead to high standard of cultivation. In new canal colonies of Punjab (now Pakistan) plans for all new villages on model lines were worked out simultaneously with canal construction and necessary guidance given to the people in construction of houses. This aspect may also receive consideration if haphazard growth of villages is to be avoided.

23. Towns.

Some of the existing towns in proposed canal area, like Sheopur in Madhya Pradesh, look deserted and in ruins and offer dreary look. They are bound to grow rapidly with the advent of canal and their haphazard or uncontrolled growth would prove a curse. If present Sheopur Town cannot be remodelled or its present haphazard growth regulated, then a new town, properly laid out, with wide roads near the canal, with ample supply of water for lawns, grassy plots, ornamental shady or fruit trees, would be a place of envy; and market places or *Mandies* with warehousing facilities, can be thought out and planned now *before it becomes too late*.

24. Pucca roads.

With the on-set of Monsoon, most of the roads in the proposed canal area get out of order and villages remain completely cut off during Monsoon. Punjab had happy experience of constructing pucca roads, almost simultaneously with canal construction which immensely helped in opening up and developing the new areas leading to the prosperity of the people. The matter deserves consideration at this stage.

25. Warabandi.

The usual practice in Harsi Dam Canal Area (Madhya Pradesh) on the part of cultivators is, to take *any amount* of water *at any time* for *any length* of period, during the period a minor runs, with the result, that cultivators at the head get excess supply of water to the extent that lands

get water-logged, while crops at the tail-end dry up for lack of irrigation, thereby embittering relations between cultivators themselves. The *Warabandi* of the type, existing in Punjab, (whereby each cultivator, whether at the head or at the tail-end gets water according to his turn) is indispensable. Immediate steps should be taken to popularise this and enforce this from the very beginning if serious trouble is to be avoided. The Team is glad to note that this suggestion was readily accepted and Chief Engineer Madhya Pradesh sent his superintending Engineer to Punjab to study *Warabandi* system.

26. Main field channels.

Although it is the responsibility of the villagers to construct and maintain main water channels, yet it would be better if construction (and *not* maintenance) could also be the responsibility of canal authorities. This seems necessary on account of lack of experience on the part of the cultivators, coupled with undulating and uneven nature of the land which adds to the difficulties. In fact, even in regard to the alignment of water-courses or field channels, some technical guidance will be necessary from Irrigation Department for which training should be arranged right now to avoid eleventh hour troubles. We have already referred to this problem earlier.

27. Malaria problem.

The existence of numerous depressions all over the places (where water is bound to stagnate and provide ample scope for mosquito breeding) would accentuate malarial problem and spleen percentage is said to be already very high.

28. Co-operative garden colonies.

There is good scope to establish co-operative garden colonies of the type started in Punjab, not only to prevent retired people from settling in the cities and to enable them to lead a useful and productive life in rural areas but to lay the foundation of fruit industry on most scientific lines. The foundation of Fruit Industry in California, so famous all over the world, was laid largely by the people who had retired from active life and found horticulture, not only a good hobby but highly paying proposition. The State authorities are inclined to accept the suggestion and details are being worked out.

29. Co-operative farming.

If it is at all to be a success in India, there is scope for starting an experiment in these two States as culturable waste land is available which can be given to the progressive farmers to farm on cooperative basis from the very beginning. This will help in determining to what extent, cooperative farming can be a success at least under favourable conditions. The other

alternative is to lease out, on long term basis, sufficiently large area of culturable waste land to some progressive persons possessing necessary capital and technical 'know-how' who may reclaim the land, set high standard of farming, reap benefits for a certain number of years and then either pay its price or handover the land back to the State--to be run as cooperative farms or to be divided amongst peasants.

30. Soil erosion.

Soil erosion is a most serious problem in both the States and is rapidly devastating large areas of land, so much so, that about 30 per cent. of the total culturable area in Rajasthan is said to be already ruined by soil erosion. The trouble is almost equally bad in several parts of Madhya Pradesh coming under Chambal Project. Apart from gullies and ravines, other types of erosion like rill or sheet erosion, although imperceptible to an untrained eye, is also washing away upper fertile soil, even from lands looking apparently level or only slightly sloping. This is likely to be hastened by the advent of canal irrigation unless certain precautions are taken, and it will be the duty of Irrigation and Agriculture Departments to popularise agricultural practices like contour, strip cropping, terracing, levelling, proper crop rotation, bunding etc. So far as gullies and ravines are concerned, they will have to be tackled not only by the State Authorities but by the Central Government as the problem is even beyond the resources of the State. Since the soil erosion is not directly concerned with Chambal Valley Work, this subject is proposed to be dealt with separately.

31. Financial provision.

Extensive discussions have taken place between the Team and the State Governments and their officials. The Chief Minister of Rajasthan has already participated in these discussions and the Chief Minister of Madhya Pradesh has been kept fully informed by the Leader of the Team. Proceedings of all the meetings are not reproduced in this report for the sake of brevity excepting those of two meetings of each State as also the reports of Chief Engineer and Deputy Chief Engineer (Irrigation) Madhya Pradesh, which are of vital concern and given in Appendices numbered XV, XVII, XVIII, IXX, IXX-A, XX, XX-A, XXI & XXI-A.

Urgent need for providing drainage system in Gohad and Mehgaon Tehsils of Madhya Pradesh to prevent water-logging and salinity as referred to previously, has been agreed to. Its cost is being worked out by the Irrigation Department which is roughly estimated at about ten lakhs of rupees according to the Chief Engineer Chambal. This is being provided for by Irrigation Department. In working out the financial implications of agricultural schemes, utmost care has been taken to keep the expenditure at lowest level by utilizing the facilities of lands, buildings, equipment and farm animals wherever existing on the Government farms and utilizing the funds and staff already provided for in the budget of respective state Agricultural Department and only additional expenditure required has been

worked out. Further, expensive schemes like development of land to make it fit for irrigation costing about Rs. 46.5 lakhs in 3 years in case of Madhya Pradesh and Rs. 30 lakhs in case of Rajasthan are proposed to be run on 'no profit no loss basis' i.e. the cost to be recovered from cultivators in 5 annual instalments and only those lands are to be tackled, the owners of which undertake to pay back the cost in instalments, alongwith their land revenues. Likewise the scheme of mass-scale production of nursery plants of high quality stock, for supply to public can be expected to be run easily on self-supporting, if not actually on paying basis, even if plants are sold at much less than market price. This means that although a total provision of Rs. 57 lakhs in case of Madhya Pradesh and Rs. 59 lakhs in case of Rajasthan for a period of 3 years will have to be made yet, the net expenditure, after recovering loan from cultivators, would not amount to more than 4 to 5 lakhs of rupees a year for each State (*vide Appendices XXI & XXI-A*), which is too insignificant an amount, considering the enormous good that it can do. The break up of cost of the agricultural scheme is already with the State Governments and it has also been supplied to the Planning Commission with the suggestion that necessary provision be made in the next year's budget. Unless this is done as a matter of priority, the financial success of the entire Chambal Project may be jeopardized for lack of proper facilities for agricultural development. In fact, the loss to the cultivator and the State will be tremendous.

Dr. M. S. Randhawa I.C.S., Vice-President, I.C.A.R. in his D.O. letter No. 50(4)/58-CDN dated 25/26th March, 1958 addressed to Secretary, COPP (Vide Appendix XXI-B) has also stressed the importance of agricultural schemes suggested by the I & P Team and offered to finance some of the schemes from the funds of the I.C.A.R. and not to allow the work to suffer.

32. Incentive for development of waste lands.

Some of the land to be brought under irrigation needs considerable improvement by way of clearance of *ber* bushes and levelling of steep slopes and ravines. This is bound to take time as not only labour but capital is involved. In case of such lands it may be quite appropriate in the interest of expediting the utilization of water for irrigation if relatively bigger holdings are entrusted to private enterprise and ceiling of ownership of land and other tenancy laws are not applied for a period of say 25 years. In this way, there will be incentive for the mto invest money and put in effort on the land in order to reap the benefits of irrigation. In the absence of some such special measures, there is bound to be a retardation in the development of irrigation and consequent loss of food production. The Project Report puts down a programme of 10 years for full development of 7 lakh acres.

33. Betterment levy.

The investment on the Chambal Project is of such an order that its financing must be made the responsibility not only of the Government but also of the people who are to derive benefits from it. The lands and property in both these States which without water would have remained unproductive for an indefinite period, are bound to appreciate in value with the introduction of irrigation. As such the increase in value should impose an obligation on the owner of land to contribute towards the repayment of the capital investment on the Project. Therefore, on Multi-purpose Projects, the levy of betterment charges has already been acknowledged as a just and necessary requisite.

On the Lakkavalli Project, the betterment levy has been levied in terms of the Government order passed by the Mysore State on such levy. We have referred to this in our Report on the Project. This system has been in vogue in that State for quite a long time.

In the Project Report on the Chambal Scheme, a betterment levy of Rs. 75 per acre has been assumed for the calculation of financial returns. The Leader had a discussion with Shri Takhatamal Jain, Minister for Agriculture, Government of Madhya Pradesh and was informed that a suitable legislation was being considered. The Chief Engineer Rajasthan (Irr.) reports that the question of betterment levy is still under consideration of the State Government. The necessity of a betterment fee is beyond doubt. Certain principles have to be laid down in this respect and one of them would be that the rate of levy should be half the estimated increase in the value of the land as a result of the benefits of irrigation of the area per acre.

CHAPTER VI—POWER GENERATION

1. Power Resources.

The present scheme under construction, in regard to generation of power, consists of the installation of 4 generating units of 23,000 KW each at Gandhi Sagar Power Station. Provision has, however, been made for the installation of a 5th unit of similar capacity at a later date.

To meet the load demands expected after 1960, it is planned to construct the Rana Pratap Sagar Power Station, at a site about 20 miles downstream of Gandhi Sagar, with an initial capacity of 84,000 KW. A third power station at Kotah Dam below Rana Pratap Sagar will be constructed later on.

The power supply and demand position in the areas covered by the Chambal transmission system in Madhya Pradesh and Rajasthan are summarised in the Table below:

	Firm capacity from public supply thermal power stations by 1960 KW	Load Demand KW		
		1955-56 (Actual)	1960-61 (As estimated by the C.W. & P.C.)*	1965-66
Madhya Pradesh .	17,500*	11,715	66,200	141,500
Rajasthan .	16,500*	12,985	57,900	115,800
	34,000	24,700	124,100	257,300

It will be seen that the existing public utility thermal power stations in the region can provide a firm capacity of 34,000 KW exclusively from efficient new generating plant in the stations.

The working tables for the coordinated operation of Gandhi Sagar and Rana Pratap Sagar reservoirs indicate that it would be possible to meet a system demand of 166,000 KW at 60% load factor by the combined operation of the hydro stations at Gandhi Sagar and Rana Pratap Sagar. Considering the operation of Gandhi Sagar reservoir alone prior to full irrigation

*See Appendices XI-A & XI-B.

development, it is found from a working table prepared for the period October, 1947 to September, 1955, starting with the reservoir full (R.L. 1312) on 1st October, 1947, that it is possible to generate hydro energy varying from about 310 to 780 million units per annum, or an average of 465 million units per annum.

If the 5th unit, for which provision has already been made in regard to the civil works, is also installed at Gandhi Sagar it would be possible to obtain a peak output of 92,000 KW from 4 units, treating the 5th unit as a standby. However, when the reservoir level is minimum, it would be necessary to run all the 5 units and the output obtainable would be about 86,000 KW. Hence, taking into account the firm capacity of 34,000 KW provided by the new thermal plants, it would be possible to meet firmly a system demand of 34,000 plus 86,000=120,000 KW by the installation of the 5th unit.

The energy requirement corresponding to a demand of 120,000 KW at 60% load factor is 631 million units per annum. At Gandhi Sagar, it is possible to generate 465 million units on an average. The balance will have to be generated from the thermal plants. This is possible as the thermal plants could, if required, generate 298 million units corresponding to the firm capacity of 34,000 KW. (The question of coal consumption is examined in subsequent paragraphs). It is therefore seen that the power resources available in the thermal power plants *recently installed and in those planned for execution presently* and in the hydro station at Gandhi Sagar are sufficient to take care of a demand of 120,000 KW at 60% load factor.

During the year 1956, the thermal stations in the region, namely Jaipur, Gwalior, Indore and Bhopal generated about 78 million units and consumed about 98,500 tons of coal. In the year 1957, the allotment of coal to these power stations from January to November has been 140,000 tons. By the integrated operation of the Gandhi Sagar station with the new thermal plants as suggested herein, more thermal generation than now may be necessary but it is possible to minimize it. To begin with, irrigation would not have fully developed and the operation of the power system would utilise the Gandhi Sagar station to the full extent that water resources permit and meet only the balance of load demands by thermal power. Also, Gandhi Sagar storage can be drawn down temporarily to minimize thermal generation and the storage built up as soon as Rana Pratap power becomes available.

In the early stages of load development, the system load factor will be lower than 60% and it may be possible to meet the entire load demand by operating 5 units at Gandhi Sagar Power Station only. As the system load grows and load factor improves, thermal support could be brought in gradually. Prior to full irrigation development, keeping the reservoir full

(R.L. 1312) at the end of the Monsoon on 1st October and by drawing down the reservoir to as low a level as possible by the end of June and building it up during the Monsoon, it is possible to generate maximum hydro energy. In a good year, there will be no need for thermal generation at all except for about an hour or so per day to meet the peak demand. In years of average or low rainfall it would be necessary to supplement the hydro energy by thermal generation. It is expected that the average coal consumption per annum may not exceed what it would be say in 1958.

Another advantage of the integrated operation with the thermal stations would be the improvement in the performance of the unusually extensive (about 1,000 miles) transmission network associated with this Project which has an ultimate hydro potential of about 200,000 KW in the three hydro stations. Normally in a well-developed region, this quantum of power would be absorbed in a distance of about 200 miles. This point is further detailed under sub-head 2.

It is noted from the forecasts of load demand that in a period of 5 years (1955—60) the demand has been assumed to increase over 5 times. Normally, the demand doubles itself in 8 to 10 years in fairly well-developed countries. Assuming that the pace of economic development of the Chambal region is accelerated, we may expect the demand to double itself in 5 years. At the time the load surveys were made by the C.W. & P.C., the present financial difficulties which the country is facing were not foreseen especially as regards foreign exchange. Moreover, the former states of Madhya Bharat, Bhopal and Ajmer have since been integrated into Madhya Pradesh and Rajasthan. Some of the load demands that were expected to mature based on certain financial assistance said to be forthcoming from the former governments of Madhya Bharat, Bhopal and Ajmer will therefore have to be reviewed and reassessed.

Taking into account all the large and heavy industries that would be definitely coming up in the region and assuming that the other types of loads will double in 5 years, we have estimated (Appendix XI-C) that the load demand in the region would be of the order of 88,000 KW by 1960-61 and 176,000 KW by 1965-66. It would appear that the Gandhi Sagar Hydro Station equipped with five 23 MW machines and interconnected by main and sub-transmission lines with existing and planned thermal power stations in the region, as depicted in the Map, (Appendix XI-D) may be found adequate even for the loads that may materialise in 1963. The installation of the 5th unit at Gandhi Sagar helps not only to take care of the load demand in the interim period till additional hydro capacity is commissioned in the region but also provides spare generating capacity for all the three hydro stations at Gandhi Sagar, Rana Pratap Sagar and Kotah in the ultimate stage.

There is no doubt that it would be necessary to utilise the resources of hydro power at Rana Pratap Sagar also as the system load grows up. It is therefore desirable to phase portions of the construction of the Rana Pratap Sagar Dam and civil works for the power house in the Second Five Year Plan period itself so that constructions there could be kept going at a minimum level economically; they could however be accelerated to the necessary extent if any unforeseen development of new loads does come about earlier than now considered probable. The delivery schedule and the programme of erection of the power plant at Gandhi Sagar indicate that it is possible to commission a hydro plant within 4 years of the date of placing orders for the equipment. Depending on the rate of load growth that would be indicated by the time the Gandhi Sagar station commences operation, a schedule may be drawn up for placing orders, erection, etc., for the Rana Pratap Sagar power plant.

2. Transmission system.

The transmission lines needed for interconnecting the thermal stations and the load centres with the Chambal grid are shown in the map. The sections of the transmission system lying in Madhya Pradesh have all been approved by the Planning Commission. With regard to the Rajasthan portion of the transmission system, a sum of Rs. 420 lakhs has been provided in the Second Plan for the following transmission lines and their associated grid sub-stations.

1. Gandhi Sagar-Kotah-Sawaimadhopur, 115 miles, 132 kV.
2. Sawaimadhopur-Jaipur, 75 miles, 132 kV.
3. Kotah-Ajmer, 120 miles, 132 kV.
4. Kotah-Bhilwara, 80 miles, 66 kV.

Subsequently, the Government of Rajasthan have suggested that the Kotah-Bhilwara 66 kV line (item 4 above) may be omitted and the following transmission lines may be included.

1. Neemuch-Chittor-Bhilwara, 75 miles, 66 kV s/c.
2. Neemuch-Udaipur-Zawar, 100 miles, 132 kV s/c.
3. Jaipur-Rajgarh, 60 miles, 66 kV s/c.

It is understood that it has been definitely decided to locate a Zinc smelter at Udaipur. As it is essential to ensure reliable power supply to the Zinc smelter, it is desirable to run a double-circuit 132 kV line from Gandhi Sagar to Udaipur via Neemuch instead of the proposed single-circuit line. Also, the 132 kV line may be terminated at Udaipur and a single circuit 33 kV line may be run from Udaipur to Zawar to supply the mining load of about 3,000 KW.

The proposed 66 kV line Neemuch-Chittor-Bhilwara may be approved.

The sanctioned 132 kV, 120 mile line from Kotah to Ajmer may be omitted for the present, as the load expected in Ajmer in 1960 does not justify it. Instead, the 66 kV line from Jaipur to Phulera may be extended to Ajmer. Taking into account the effect of the synchronous machines at the Jaipur thermal power station, the voltage level at Ajmer will be satisfactory for the 1960-61 loads. The Kotah-Ajmer line may be constructed in the Third Five Year Plan.

The proposed 66 kV line from Jaipur to Rajgarh may be approved. In addition, it would be necessary to construct 33 kV lines from Rajgarh to Alwar and Bharatpur to interconnect the capacity of new thermal stations with the grid.

For the additional works suggested herein, the following financial provision would be required:

	Rs. Lakhs
1. 5th generating unit at Gandhi Sagar and necessary step-up transformer, switchgear etc.	45
2. Phulera-Ajmer, 66 kV, 50 miles, s/c	25
3. Jaipur-Rajgarh, 66 kV, 60 miles, s/c	30
4. Rajgarh-Alwar, 33 kV, 25 miles, s/c	5
5. Rajgarh-Bharatpur, 33 kV, 55 miles, s/c	11
6. Neemuch-Chittor-Bhilwara, 66 kV, 75 miles s/c	37
7. Gandhi Sagar-Neemuch, 132 kV, 2nd circuit 47 miles	25
8. Neemuch-Udaipur, 132 kV, 75 miles, d/c	64
9. Udaipur-Zawar Mines, 33 kV, 16 miles, s/c	3
10. Additional sub-stations and switchgear associated with the above transmission lines	74
TOTAL	319

For the funds required for the construction of the above works, a sum of about Rs. 85 lakhs which is the estimated cost of the Kotah-Ajmer 132 kV line and associated switchgear is available from the provision of Rs. 420 lakhs for the Chambal transmission system in Rajasthan. The balance of Rs. (319-85) or Rs. 234 lakhs may be met from the provision of Rs. 500 lakhs in the Second Plan for the construction of Rana Pratap Sagar Dam and Power Station and the 4th generating unit at Gandhi Sagar. There will still, therefore, be provision for maintaining construction activity at Rana Pratap Sagar Dam site at a satisfactory economic level.

It is recommended that a Network Analyzer Study of the system be made with a view to determine the power transmitted by the various sections of the transmission system, voltage levels at sub-station busses, synchronous condenser capacity, etc. By interconnecting existing thermal power stations into the transmission grid, it will be possible to use the generators of the thermal sets as synchronous condensers initially. Transmission system performance will be improved and the cost of installing regular

synchronous condensers can be postponed. Based on the results of the Network Analyzer Studies, the design of the transmission system may be suitably modified. Perhaps it would be desirable to design the line from Jaipur to Ajmer for 132 kV although it may be operated initially at 66 kV.

3. Economy in the use of steel.

Considerable economy in the use of steel can be achieved by using wood poles for transmission lines of 66 kV and below. A 66 kV power line would require approximately 8 tons of steel per mile. The total length of 66 kV transmission lines in the Chambal grid for which materials have not yet been ordered is about 185 miles (all in Rajasthan) and this would require 1,480 tons of steel which could be saved by utilising wood poles. Even if the wood poles last for only 15 years it is worthwhile using them now as there is serious shortage of steel in the country. The position may be reviewed at the time the wood poles have outlived their useful life. It is understood that suitable Sal poles are available in good numbers in the forests of Uttar Pradesh around Dehra Dun and Naini Tal. Exploitation proposals that may be under consideration should be expedited for procurement and the pressure treatment of these wood poles, for use in transmission and sub-transmission networks.

It is understood from the C.W. & P.C. that the available resources of the Forest Departments of the various States have been geared to the supply of wood poles required for distribution and rural lines and it would not be possible at present for the States to supply the poles required in lengths of over 35 ft. for transmission lines. However, it may be mentioned that in countries like Russia and Sweden, small lengths of poles are suitably jointed together and used as H-frame construction even for 110 kV transmission lines. It would be worthwhile for us to explore the possibilities of adopting similar types of construction in this country also. With regard to the treatment of poles, it is understood that ASCU Products (Private) Limited, Calcutta, are willing to put up pressure treatment plants wherever required.

Alternatively, it is suggested that reinforced concrete poles cast *in situ* could be adopted. Recently, the Indian Standards Institution have brought out in collaboration with the C.W. & P.C. their specifications (No. IS/785-1957) for R.C.C. poles and this could be followed for the manufacture of these poles.

4. Progress of electrical works.

It is expected that the Gandhi Sagar Power Station would start functioning by December, 1959. The status in regard to procurement of materials and erection of the transmission lines as on October, 1957, is indicated in Appendix XI-E. It would be seen that so far as the transmission lines to be erected by the Rajasthan Government are concerned, the tenders for the supply of materials were received only on the 30th September 1957.

These will have to be scrutinised, orders then placed for materials, etc. With regard to the grid sub-stations, the enquiries for tenders were issued, only recently. It is, therefore, doubtful if Rajasthan would be in a position to utilise Chambal power by December, 1959.

The major handicap for the speedy execution of power system constructions appears to be the shortage of technical personnel. The organization chart for the Electrical Circle in the Madhya Pradesh region shows that 8-Ex. Engineers, 12-Construction Superintendents and 32-Ass'tt. Engineers are required for the work. It is understood that only the Superintending Engineer and a couple of Ass'tt. Engineers have been enlisted and are working at present. The main reasons for not obtaining the services of engineers in adequate numbers were the comparatively lower scales of pay offered by the former Madhya Bharat Government and the want of security of continued employment and recognition of previous service rendered in another project for purposes of seniority, etc. It is suggested that this state of affairs should be remedied immediately and trained personnel should be offered attractive terms and deputed to this Project on an urgent basis. It is particularly emphasised that the C.W. & P.C. should consider sparing for this Project, some officers who, being familiar with the designs, could be of help to accelerate execution in the field; they would also obtain valuable field experience.

5. Sharing of power between Madhya Pradesh and Rajasthan.

The Madhya Pradesh Government have already formed a State Electricity Board under the provisions of the Electricity Supply Act (1948). A similar Electricity Board has just been constituted in Rajasthan also. For deriving early and maximum benefits from the sale of power that will be developed by the Chambal Project in successive stages of its construction, it is essential that the State Electricity Boards of Madhya Pradesh and Rajasthan should co-operate very closely and plan on the full utilisation of the power as it will be available from the installations of hydro generating units, first at Gandhi Sagar Dam and later at the dams proposed to be built along the Chambal River below the Gandhi Sagar Dam. In planning for power development and utilisation in this manner, care should be taken that the programme is not impeded by a literal interpretation of the Agreement that the power available at the dams should be shared equally between Madhya Pradesh and Rajasthan. It is quite likely that the two administrations will not be equally ready with their respective transmission lines, sub-stations, and load developments to utilize their respective shares of hydro electric power at the same rate after power becomes available at Gandhi Sagar Dam. It would defeat the main purpose of the Chambal River Valley development if hydro power remains un-utilised for any length of time because a particular administration is not ready with one measure or another to utilise it. It will be possible to arrive at short-term power sales understandings between the two Electricity Boards for continuous and full utilisation of hydro power as it becomes available gradually in greater

measure. Power may be made available for all consumers who can make effective use of it irrespective of where they are, whether in Madhya Pradesh or in Rajasthan. Hydro power may be given temporarily to industries having their own generating plants and this would save unnecessary burning of fuel. This quota of hydro power could be withdrawn temporarily by notice later when the other administration is ready to utilise it, while further hydro capacity development is taken on hand. Equitable arrangements can be devised to distribute the total revenues from the sale of power between the two Administrations by short-term agreements for sale of surplus power temporarily. Such a load-building programme will keep the total power generating facilities fully loaded all the time and will facilitate early and profitable construction of the Rana Pratap Sagar Power Station and other power stations down below.



CHAPTER VII—WORKS NEEDING URGENT ATTENTION

The phasing of construction for the balance works on the Chambal Project points to the desirability of completing the jobs undertaken with the fullest possible speed.

Gandhi Sagar Dam

The Gandhi Sagar Dam is programmed to be completed in all respects by 1959-60. As already stated in the Report earlier, the masonry work is expected to be completed by June, 1959, adequate storage thus being effected for generation of power and for irrigation.

Power generation

Though there have been slight delays in respect of certain items relating to the generation of power at the Gandhi Sagar Dam, all the machinery are being received and the generation of power can be expected to be realised before the end of 1959.

Transmission

The same thing cannot, however, be said in respect of transmission lines both in Madhya Pradesh and in Rajasthan. This particular item needs immediate attention both as regards procurement of materials and erection so as to obtain the benefit of power soon after power plant is ready for operation.

Irrigation

As for irrigation the completion of the Kotah Barrage including the erection of gates by June, 1959, is a necessity.

Earthen section

The final design for the Kotah Barrage Bund Section has been decided and programme for completion of this work by June, 1959, has also been fixed up. With the achievement of this target the synchronisation and the availability of storage with utilisation will have been obtained.

The design, as already indicated, involves large quantities of earth work required for impervious and semi-pervious zones and the clay blanket 550 ft. long and 10 ft. deep and of stones required for Rockfill; placing of filters according to design particularly on the downstream side, clay grouting of the areas between the bottom of the sheet piles and the bed rock and insertion of bleeder or relief wells.

It is, therefore, imperative that a very careful schedule needs to be prepared (i) for the execution of these various items upto about the level of the river bed during this working season before the advent of Monsoon and the floods in the river, and (ii) for the completion of all works well in time before the Monsoons of 1959.

The clay grouting and the construction of the bleeder wells have been stated by the experts to be of a special nature requiring meticulous care and attention both in the stage of design and execution. It has to be stated that the working space being somewhat restricted, the several operations on various items of work have to go on in a systematic manner concurrently.

Radial gates

The sill of the canal sluices being higher than the top of spillway masonry crest, it is essential that the 19 gates should be erected with all the hoisting equipment, etc., before irrigation could be started.

As a result of the Global Tenders invited by the Director General of Supplies and Disposals, the work of manufacture and erection of the 19 Radial gates was entrusted to the Executive Engineer, Workshops and Machinery Division, Tungabhadra Dam, on 12th January, 1957. As per the conditions on the acceptance of tender, the erection of the gates was expected to be completed in 540 days from the date of the receipt of the acceptance of the tender, subject to the required steel materials and motors being available. The agreement also contemplated the supply of steel for the work by the Ministry of Heavy Industries on 'Top Priority' basis in three months for embedded parts and six months for the rest. According to this, the date of completion of the work was July, 1958. A detailed programme had been drawn up to achieve this target.

There has been considerable difficulty in the steel material being supplied to the Tungabhadra Workshop. The Team examined this position with the Chief Engineer, Tungabhadra Board and the Superintendent, Workshops when the Team visited the Mysore State in July last. The matter was taken up with the authorities concerned and as a result, arrangements are said to have been made both in regard to the procurement of foreign exchange and the necessary steel for the work. The C.W. & P.C. in consultation with the Workshop, have also made a few changes in the design to avoid certain sections of steel which are difficult to obtain and to utilize the comparatively easily available sections.

Under the present circumstances, the Tungabhadra Workshops expect to complete the entire work by March, 1959. The Workshops necessarily had to modify the programme of work, with reference to the dates of delivery of steel, manufacture, transport and erection.

The Team suggest that the Control Board should arrange for the necessary agency to watch the progress of work at various stages to see that every item in the schedule is adhered to and the target achieved and also in case of certain shortfall, if any, to get the schedule revised in time for greater expeditious work so that ultimate date for the completion of the work may not be extended beyond March, 1949.

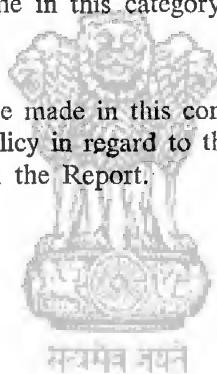
This is very important, for there has already been a set-back by one season. Any delay in regard to the work of gates would lead to a further delay of one more season.

Masonry structure—canals

Besides the completion of the Kotah Barrage, special emphasis needs to be put on several cross drainage works on canals including railway crossings which must be completed in the winter of 1959-60. The major aqueduct Kali Sind and Parwan under construction by the N.P.C.C. and the Kunu Syphon being done by contractors Gammons who are experts in prestressed concrete come in this category.

Field channels

Reference is again to be made in this connection to the need of finalising at an early date the policy in regard to the excavation of field channels as already stated earlier in the Report.



CHAPTER VIII-COSTS OF PROJECT

The original estimate for the First Stage of Chambal Hydel Scheme comprising the construction of Gandhi Sagar Dam with Power Station, the Kotah Barrage, the transmission lines and the canals in Rajasthan and Madhya Pradesh was for Rs. 48·03 crores. This estimate was prepared on the basis of certain data regarding the cost of submersible land, prices of steel and cement obtained at that time.

It has been found necessary to alter the plan of distribution of power both in Rajasthan and Madhya Pradesh.

The cost of compensation of land coming under submersion and that of rehabilitation of persons expropriated from the Reservoir area and prices of steel and cement have gone up. The estimates had, therefore, to be revised accordingly, and the cost now comes to Rs. 63·6 crores. (*Vide Statement I*).

The expenditure upto the end of December, 1957, is Rs. 15 crores *i.e.* a substantial portion of the balance remains to be spent in the remaining period ending 1960-61. The estimate of the amount required for items other than actual work *viz.*, the Power House Equipment Gates for the Gandhi Sagar Dam, materials for Transmission Lines and Sub-Stations, Crest gates for Kotah Barrage and compensation of land amounts to Rs. 15·75 crores. Most of this expenditure will be incurred hereafter.

The Chief Engineer, Madhya Pradesh, has given a programme of expenditure (Statement No. II) for completing the Project and he is confident of securing adequate progress. From the data given in statement No. III, it is seen that with certain stepping up of progress and adequate arrangements for posting of personnel, this is considered practicable and the target can be worked up.

In Rajasthan the canal works are in good progress, Kotah Barrage will have to be completed by June, 1959 by making all necessary arrangements and strengthening the organisation.

STATEMENT I

BUDGET ALLOTMENT AND EXPENDITURE POSITION

	Original Estimated cost in lakhs of rupees	Revised Estimated cost in lakhs of rupees	Expenditure upto end of 56-57 in lakhs of rupees	Budget allotment for 57-58 in lakhs of rupees	Expenditure during the year upto Dec. '57 in lakhs of rupees	Total expenditure upto date in lakhs of rupees	Balance to be spent
<i>Madhya Pradesh</i>							
1. Gandhi Sagar Dam	890.0	1360.25	497.73	118.14	127.30	625.03	735.22
2. Gandhi Sagar Power Station	500.00	479.12	41.61	24.66	17.87	59.48	419.64
3. Transmission System	449.00	577.68	3.24	51.38	6.38	9.62	568.06
4. Right Main Canal	1304.00	1774.20	222.02	106.41	96.84	318.86	1455.34
<i>Rajasthan</i>							
1. Kotah Barrage	307.00	382.55	149.58	70.92	23.88	173.46	209.09
2. Left Main Canal	186.00	219.44	69.19	36.18	20.48	89.67	129.77
3. Right Main Canal	762.00	1046.09	138.81	117.90	46.18	84.99	861.10
4. Transmission System	405.00	520.04	0.06	23.00	0.40*	0.46	
5. Rana Pratap Sagar Dam	4803.00	6359.37	38.65	10.00	1.17	39.82	519.58
TOTAL			1160.89	558.59	340.50	1501.39	4897.80

There is an expenditure of Rs. 2.93 lakhs on Korah Power Project up to year 1951-52, which is to be charged to the first stage development of Chambal Valley scheme.

*Upto November, 1957.

The figures given above are as per Statement enclosed with the comments of the Central Board. The outlay on Rana Pratap Sagar Dam has been included as expenditure has been incurred under the I stage of Development of the Project.



STATEMENT III

CHAMBAL VALLEY DEVELOPMENT

Statement showing grants and outlays on the Chambal Project (M.P. portion) for the past years and requirements for completion

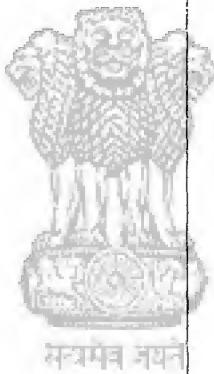
(Rs. in lakhs)

Sl. No.	Name of Scheme	Original Estima- ted cost.	Revised Estima- ted cost	Outlay to end of 1956-57	Revised Budget Estima- tes for comple- tion 1957-58 (As proposed)	Requirements for comple- tion 1958-59	1959-60	1960-61	1961- 62	1962- 63	Re- marks	
		1	2	3	4	5	6	7	8	9	10	11
1	Gandhi Sagar Dam	890.00	1350.00	497.51	260.00	592.49	400.00	192.49	..	..	..	..
2	Right Main Canal	1304.00	1750.00	221.29	200.00	1328.71	350.00	350.00	350.00	200.00	78.71	
3	Gandhi Sagar Power Station	500.00	500.00	42.12	58.00	399.88	150.00	249.88	..	..	..	..
4	Transmission system	449.00	649.00	..87	32.00	615.13	225.00	390.13	..	..	..	..
TOTAL		3143.00	4249.00	762.79	550.00	2936.21	1125.00	1182.50	350.00	200.00	78.71	

(Sd) A. K. Char, (24.10.57)
C. E., Chambal H. & I. Scheme, M. P.

STATEMENT III
TEMPO OF PROGRESS AND COMPLETION IN TIME

Volume of work done in M.cft. during :									Balance of quantities to be done as on 1-10-57 (years) (in M.cft.) necessary for completion upto June (5/4)	Number of working seasons (years)	No. of working seasons	Remarks
3† months (Jan.-March 57)	3† months (April-June 57)‡	6 months (1+2) months	One season of 12 months	to be done as season	on 1-10-57 (years)	(in M.cft.) necessary for completion upto June (5/4)	from 1-11-57					
1	2	3	4	5	6	7	8	9				
Gandhi Sagar Dam												
Masonry and concrete	1.74	1.6	3.34	5.6	14.0	2½	1.8					
Right Bank Canal (M.P.)												
(a) Rock cut	2.60	1.84	4.44	7.4	17.56	2.36	3.8	Work would be completed within time,				
									Rate of progress needs to be stepped upto 7 mcfi./yr.			



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	1	2	3	4	5	6	7	8	9	
(b) Earth work	54.6	50.1	104.7	174.5	1093.00	64	3.8			Rate of progress needs to be stepped upto 300 mcft./yr.
(c) Masonry and concrete	.0.4	0.67	1.07	1.68	6.00	32	3.8			
<i>Left Bank Canal (Raj.)</i>										
(a) Rock cut	0.59	0.59*	1.18	1.96	0.47	1	3.8			
(b) Earth work	20.3	20.3*	40.6	66.8	34.39	1	3.8			Work will be completed in time.
(c) Masonry and concrete	0.26	0.26*	0.52	0.87	0.84	1	3.8			
<i>Right Bank Canal (Raj.)</i>										
(a) Rock cut	2.84	2.84*	5.68	9.5	7.0	1	3.8			
(b) Earth work	59.10	59.10*	118.2	197	316.5	1.6	3.8			
(c) Masonry and concrete	0.72	0.72*	1.44	2.4	10.66	4½	3.8			Rate of progress needs to be stepped upto 3 mcft./yr.

[†]Figures in Cols. 1, 2 and 3 are taken from Progress Reports.

*Figures for the quarter April-June, '57 were not available and therefore, those for the previous quarters are repeated.

‡ As it is planned to make available irrigation benefits after 1959 June, separate Schedules of year-wise irrigation development of canals and their structures falling in each zone need to be separately prepared and fulfillment thereof watched, e.g., the portion coming in the first zone (adjoining the canal take off) will have to be completed by June' 59.

The Chambal Scheme having been included amongst the high priority Projects it can be expected that adequate and needed grants would be made available.

Economies.

In this connection the team has made certain suggestions to effect economies which will result from rephasing the programme and dovetailing certain Sections of construction in order to make maximum utilisation of the available Plant, Personnel and Buildings.

The items under which such economies are considered possible are as follows:—

Rana Pratap Sagar Dam

The machinery and equipment which will become available from the Gandhi Sagar Dam construction and Kotah Barrage and other works, can certainly be utilised for Rana Pratap Sagar. The dovetailing of the work of Rana Pratap Sagar Dam with that of Gandhi Sagar Dam will unquestionably lead to economy in construction, besides greater efficiency.

Economies that will become possible by such implementation are:

	Rs. lakhs
(i) Buildings	32
(ii) Establishment	11
(iii) Machinery and equipment	11
TOTAL	54

Note.—Depending upon detailed construction plant layout, the economy under machinery and equipment is expected to be about Rs. 25 lakhs. However, the figure of Rs. 11 lakhs have been adopted to remain on the conservative side in case the job is not as much mechanized as Gandhi Sagar Dam (Appendix X).

2. Acceleration of Canal Construction.

Chief Engineer, Chambal, Madhya Pradesh, is in full agreement that acceleration of this work is possible if organisation is strengthened. Already rate of progress on earthwork has been in excess of the target both for machinery and manual labour. Other difficulties are not regarded insurmountable. Availability of necessary funds is, however, essential.

Saving under this sub-head have been taken into account for establishment only. The amount estimated is Rs. 25 lakhs. (Appendix VI-B).

3. Lining of Canals

Chief Engineer, Madhya Pradesh, has agreed to the suggestion made by the Team for simplification of the specifications of lining depending on the nature of the various reaches.

The modifications include omitting of plastering and of bed lining in certain reaches. Widening of the canal has also been suggested where economically feasible. Side walls are to remain as per estimate. An economy of about Rs. 20 lakhs is expected (Appendix VIA).

Thus such economies in the estimated cost of work amount to approximably Rs. 1 crore as detailed below.

	Rs. lakhs
1. Rana Pratap Sagar	54
2. Acceleration	25
3. Lining in rockcut reaches	20
	<hr/>
	99
	<hr/>

Approximately Rs. 1 crore.

February 21, 1958

N. V. GADGIL,
Leader.



CHAPTER IX—SUMMARY OF THE REPORT

I.—History & Salient Features of Project

1.1 The Chambal Project originally estimated to cost Rs. 77 crores would consist of three storage reservoirs with power houses and a barrage with attendant canal works. On completion, it would irrigate 14 lakhs of acres and generate 210,000 KW of electricity. By the end of Second Plan, it is planned to achieve almost full irrigation benefits and to generate a maximum of 92,000 KW of power.

1.2. The Project has undergone several changes before it was officially sanctioned in 1954 though the work was started in 1953. These changes were inevitable in view of the then existing princely states which were merged in different stages subsequently while active consideration was being given to the preparation of the Project. No precise schedules of materials, technical personnel, machinery and equipment could be drawn at the commencement of the Project.

II.—Administration

2.1. The dominant impressions gathered regarding the administration of the Project are as under:—

- (a) One of the main functions of the Control Board in agricultural planning and phasing of field channels for the proper utilization of water. The former requires 2 to 3 years experimentation ahead of the target date and the latter involves complex scheduling in advance. In both these cases nothing tangible has been done so far.
- (b) Preparation of detailed estimates* and schedule* of rates is lagging badly.
- (c) Inordinate delays are noticed in the States' implementing decision taken by the Board†.

To remedy this serious situation, the report recommends:—

- (i) State Finance Secretaries should be *ex-Officio* Members of the Board;
- (ii) technical designs should be regularly subjected to check by an independent technical agency;
- (iii) an agricultural expert should be made a Member of the Board or at least consulted regularly;

*It is understood that estimates and schedule of rates are now ready.

†The Board has since evolved a suitable procedure to eliminate delays.

- (iv) the Board should set up machinery for carrying out the main functions assigned to it;
- (v) specified Executive Engineer in each Project and an A.F.A. should be made jointly responsible for preparing estimates and schedule of rates within 3 to 6 months;
- (vi) pending completion of work at (v) Chief Engineers may be given larger financial and administrative powers in respect of acceptance of tenders and sanctioning of estimates without obtaining prior concurrence of Financial Adviser; and
- (vii) the above proposals would mean a much greater burden on the Chairman of the Board than hitherto, rendering his job virtually a whole time function.

2.2. *Personnel.*—Staffing position on the Project is difficult particularly in Madhya Pradesh area. To remedy the situation the report suggests:—

- (a) The State cadres may be expanded to include the post-projects requirements so that some of the temporary incumbents could be absorbed taking into account lengths of their previous services;
- (b) the ultimate solution lies in pooling of the existing resources to the best advantage of all the projects in the country by creating an All India Reserve of Officers who could be utilised to strengthen the projects as and when necessary since each State cannot appreciate the overall situation;
- (c) as it takes a long time to recruit personnel by each Public Service Commission, a Committee consisting of a Member from each of the Commissions, each acting as Chairman alternately and two eminent engineers as other Members should be empowered to recruit the necessary personnel; and
- (d) the Project authorities should organise courses so as to fit the existing personnel to some of the routine tasks connected with the construction of the Dam, the canals and the electrical equipment for power houses and transmission lines.

2.3. *Agencies of construction.*—Some works are done departmentally, some by contracts and some in a composite way. M/s. Gammons are entrusted with the complicated work of the Kunu Syphon. In addition, the National Projects Construction Corporation has been given a large number of works costing about Rs. 2½ crores. The potentialities of this organisation are considerable especially when contracting resources all over the country are overstressed due to the increasing demands of the Second Five Year Plan.

III.—Features of Design & Construction

3.1. *Design of Kotah Barrage.*—The design of the earthen dam which forms a part of the barrage has undergone a continuous evolution involving six designs in all. After discussing the 5th design with the C.W. & P.C. the Consultative Committee stressed the necessity of devising other methods of protecting the foundations as neither the clay grouting nor the sheet piles could be considered fully effective in serving their purpose. The Consultative Committee considers that the design number six subject to modifications agreed upon on 15th January 1958 is the most satisfactory and stresses the need to programme the work into its minutest detail including strengthening of personnel. The report suggests that the retired Chief Engineers of the country should be given a proper retainer and distributed over various projects costing more than 15 crores for consultations. Each such project should have a Consultative Committee with the necessary specialised personnel. This device is specially relevant in our country so as to have an independent and objective check over the designs on Irrigation and Power Projects prepared by the State authorities or the C.W. & P.C., in view of the fact that there are no consultants available in the private sector in this field unlike in the western countries.

3.2. *Canal lining.*—The Team proposes to provide lime surkhi concrete bedding in the canal reaches passing through rocky terrain, instead of cement concrete. This alternative would result in conservation of scarce materials like cement as well as a saving of about 15 to 20 lakhs of rupees.

3.3. *Designs Organisation.*—Chief Engineer, Madhya Pradesh gets all the designs from C.W. & P.C. It is the view of the Team that some of these designs which are not of a major character could with advantage and convenience be prepared by the Chief Engineer himself. For this purpose a special design cell with suitable staffing needs to be created under the control of the Chief Engineer. Design Officers both in Rajasthan and Madhya Pradesh may be drawn from the establishment of the C.W. & P.C. who should work under the direction of the Chief Engineers, affording an opportunity to the Project Authorities of knowing the mind of C.W. & P.C. Also the Officers thus drawn from C.W. & P.C. would gain experience of changes in designs in actual construction.

3.4. *Quality control.*—The report recommends the practices followed on the Bhakra Project, that is to appoint a special inspection and control organization under the Chief Engineers, so as to have an objective analysis of factors influencing quality of work.

3.5. *Agency for constructing field channels.*—Customary practice of constructing field channels is to leave the works to the villagers themselves. But the main draw back is that it is not possible to enthuse them to the extent necessary having regard to the existing standards of people in these

areas. Therefore, it is most desirable that the Project authorities themselves should construct the channels recovering the cost from the villagers. If this is not done, it may take a long time to realise the irrigation benefits from the Project. In order to enthuse the cultivators village committees working under the guidance of an overall committee in every administrative division under the chairmanship of the commissioner concerned and with Superintending Engineer or Local Executive Engineer as Members to undertake detailed planning, should be instituted.

IV.—Phasing of Construction Programme

4.1. *Gandhi Sagar Dam and Kotah Barrage.*—There has been a delay in obtaining penstock gates which resulted in setting back the progress on the Gandhi Sagar Dam, which is now expected to be completed by 1959, instead of 1958 as originally planned. The Kotah Barrage is also now expected to be completed in 1959.

4.2. Canals and distributaries are expected to be completed by 1962-63. However, the Team feels that the period of completion of the canals could be advanced provided funds are made available. Looking to the rising tempo of work and the capacity of the machinery, it is considered that this acceleration could be achieved.

4.3. *Acceleration of construction of Rana Pratap Sagar Dam.*—The integrated development of Chambal River Valley envisages construction of Rana Pratap Sagar Dam 20 miles below Gandhi Sagar Dam. Therefore the original intention was to start the construction of the dam in the winter of 1957. Although preliminary Project report has been submitted by the Chief Engineer, Rajasthan, certain important investigations relating to power house remain to be done. The Team considers it necessary to expedite work on the remaining investigations and dovetail the construction of the Rana Pratap Sagar Dam with that of Gandhi Sagar Dam which would

- (a) facilitate installation of power plants at a short notice, when necessary ;
- (b) incidentally result in a saving of Rs. 54 lakhs by utilising some of the machinery and buildings at Gandhi Sagar Dam.

V.—Agricultural Aspects

5.1. The Team worked in close cooperation with the State authorities, both at technical level and administrative (Ministers) level, so that the recommendations are the outcome of joint discussion of the Team and State authorities.

5.2. For a Project of the size and nature of Chambal, it was necessary to have a Master Schedule before initiation of the enterprise. This shortcoming could be attributed to (a) two States concerned lacked the necessary institutional arrangement and not having Development Committee consisting of Engineering, Agricultural, Administrative and Revenue

Experts to work out the details of utilisation as done by Mysore State, and (b) the Control Board, while consisting of experienced persons in Irrigation, had no agricultural expert on it for giving serious thought to agricultural aspect. It is highly desirable to associate an agricultural expert in all the Control Boards.

5.3. The Team considers that the period of 10 years for realising the benefit of irrigation, can be reduced to half, *provided* the recommendations relating to agricultural aspect are immediately implemented. The State Agriculture Department fully agrees with this view. Economic benefit both to the agriculturists and the country, by hastening the utilisation programme, cannot be underestimated.

5.4. Presumptions of Project authorities, both in regard to *increased yield* of foodgrains and the *financial return* on the Project, are not likely to be realised. Kharif foodgrain crops would require little irrigation on account of ample rainfall and financial return will depend upon the extent to which the cultivators find irrigation a remunerative practice. On the other hand, anticipated financial returns can be easily realised and even be exceeded, if agricultural aspect of the Project is given due attention with least delay.

5.5. The agricultural problems are discussed under three headings:—

- (a) Changes in agriculture pattern.
- (b) Serious problems already existing.
- (c) Urgent steps to be taken for deriving maximum benefits from canal irrigation.

The present pattern of agriculture is distressing, people generally lazy, crop yields poor, elementary principles of dry farming not observed, farm-yard manure largely wasted, composting and green manuring almost unknown, even big cities like Kotah (Rajasthan) utilising thousands of tons of town refuse and animal dung just for filling depressions, milk yield of milch-animals, disgustingly low on account of poor feeding and poor breeding, and area under cash crops almost insignificant. All this is likely to undergo revolutionary change with the advent of canal irrigation. Future cropping pattern would largely depend *upon the extent* to which the State Agriculture Department is able to solve the problems of agriculturists under *altered* conditions.

5.6. *Water allowance* per thousand acres on this canal seems *liberal*, in view of much heavier rainfall and much higher ground water level in the former. Secondly, G.C.A. and C.C.A. require to be confirmed for various reasons.

5.7. *High salt contents* of water and high water table in the percolation wells in several areas of both Rajasthan and Madhya Pradesh—particularly in Digod Tehsil in Rajasthan and Gohad and Mehgaon Tehsils in Madhya Pradesh, point to serious danger of *water-logging* and salinity of land which must be safeguarded against, if canal irrigation is not to prove ultimately injurious.

5.8. Measures to prevent water-logging, salinity and bad drainage such as lining canals, distributaries, minors, providing satisfactory drainage system, installation of tubewells, encouraging use of pumping sets, avoiding accumulation of salts by proper culturable practices, study of sub-soil etc. are discussed, with which, the State authorities generally agree. The cost of drainage system in Gohad and Mehgaon Tehsils is expected to be ten lakhs of rupees.

5.9 Levelling of land, in many places, in order to ensure maximum advantage from irrigation and to prevent the evils of uneven irrigation, seems indispensable. The total area in each of the States requiring levelling is estimated at 15 to 20 per cent or about lakh or lakh and a half acres in each State—the total provision made being Rs. 30 lakhs for Rajasthan and Rs. 46 lakhs for Madhya Pradesh during three years recoverable from cultivators in five yearly instalments. Four alternative methods of attending to this work have been discussed.

5.10 Wild *ber* bush infesting the land in most area coming under Chambal Valley Project in both States is a serious pest. Its removal can easily increase the yield by 2 to 3 mds. of foodgrain per acre on an average for the State. Various methods of attending to this evil are discussed.

5.11 Kankar layers appearing at depths of 2 feet — 4 feet below surface soil, and also hard pan appearing in many places, require immediate experimentation.

5.12. Other matters requiring urgent attention are determination of varieties of crops, best suited under irrigation cultural practices, time of sowing, seed-rate etc. under *altered* conditions, manurial requirements under canal system, irrigation requirements of various crops and such other problems. Upon the proper solution of these questions, will depend not only the yield of crops but also financial returns to the Government on this Project. In fact, this work should have been started several years ago. Lack of preparedness can be attributed to the manner in which the States came into existence, as a result of merger of small Princely States which could hardly be expected to do any great deal of research work for want of funds. The States will have to stage double march in order to catch up with other States, not only because these two States are the biggest in India, next to Bombay, but also because there are numerous problems to be tackled, and that also, in the shortest possible time. No doubt, the new research stations are being established, staff being appointed and laboratories being fitted but unfortunately the specialists in various branches are being

scattered all over the State in order to satisfy the political claims of capitals of erstwhile Princely States. This is not in the lasting interest of the State agriculture. The agricultural experiments, to be conducted in both the States in regard to the above problems, have been planned in consultation with the States which are given in the Appendices.

5.13 Horticulture Industry has immense potentialities and can bring about revolutionary change in the agricultural economy of the two States. Although the area under fruits in both the States, at present, is very small, yet the presence of good number of fruit trees of many kinds—mangoes, citrus and papayas etc.—flourishing in many places and bearing bumper crop of good quality, indicates vast possibilities. For the development of horticulture, the gardens of erstwhile Rulers, containing trees of high quality, can play great part by supplying budwood to the Agriculture Department for mass scale production of nursery plants of pedigree stock for supply to public at 'no profit no loss basis'. The scheme in this connection has also been prepared for both the States.

5.14. *Sugar Industry.*—Area under sugarcane in both the States, at present, is very small but fertile soil, good climate free from frost, plentiful supply of canal water, point to immense scope for sugar industry. Most desirable course will be to create "Sugarcane Belts" to concentrate cane cultivation in suitable areas. This will not only lead to high yield of cane but also high recovery of sugar as two factors responsible for low recovery of sugar are (a) the time lag between the time of cutting of cane and its crushing in the factory, and (b) proper degree of maturity of cane at crushing time, and both these factors can be fully controlled if cane cultivation is concentrated in certain areas. In size, Rajasthan and Madhya Pradesh are even bigger than U.P. which has nearly 30 lakhs of acres under sugarcane and 68 sugar mills. Even a quarter of this area and 15 mills can contribute immensely to the prosperity of the two States and their agriculturists.

5.15 Storing farm-yard manure in pits, composting of town refuse and green manuring fields to maintain the fertility of soil, will have to be encouraged by necessary propaganda or Legislation. Green manuring practices would receive impetus if green manure crops are exempted from irrigation rates as done in the Punjab. The State authorities agree to take necessary steps in this direction. In the interest of dairy industry, irrigation rates on green fodder crops like berseem could also be reduced.

5.16 Consolidation of holdings would help in the better and more profitable utilisation of canal water and in fixation of *warabandi*. The State authorities agree to give priority to Chambal area for this work.

5.17 Village tanks, formerly used for storage of irrigation water, and to prevent erosion, are now going out of use and their utility in future to serve as fish tanks or for production of crops like Sangara or as an insurance against periodic closure of canal for short periods, requires consideration.

5.18 In canal-irrigated areas, residential houses of farmers have got to be, as near the fields as possible, otherwise canal irrigation has little meaning. Accordingly new villages with new houses are bound to spring up. The West Punjab (now Pakistan) had a happy experience of preparing village sites and house plans for cultivators, simultaneously with the construction of canals. Likewise new sites for mandis (markets) were also thought out. Several old towns like Sheopur (Madhya Pradesh) are growing rapidly but in a most haphazard manner. This evil can be prevented right now and proper plans prepared with warehousing facilities etc.

5.19 With the on-set of Monsoon, most of the roads in the proposed canal area, both in Rajasthan and Madhya Pradesh, get out of order, and villages remain completely cut off during Monsoon for months at a time. Here again, the happy experience of the Punjab in constructing pucca roads, almost simultaneously with canal construction, could be cited which immensely helped in opening up and developing the new area leading to the prosperity of the people.

5.20 The unfortunate practice, already prevalent in several places in Madhya Pradesh like Harsi Dam Canal area, is for the cultivator to take *any amount* of water *at any time* and for *any length* of period with the result that lands at the Head of the minor get excess water resulting in water logging and those at the tail-end, die for want of water, besides embittering relations between the farmers. This evil must be checked from the very start in Chambal area by following *warabandi* system as prevalent in the Punjab and even in Bikaner area of Rajasthan. The Chief Engineer, Madhya Pradesh, has sent his Superintending Engineer to the Punjab to study *warabandi* system there.

5.21 Construction and maintenance of the main field channels are now the responsibility of the village but it would be better for the Department to undertake this responsibility (construction only) or at any rate, provide technical guidance.

5.22 *Malaria problem*.—is likely to become more serious as spleen percentage is already said to be very high.

5.23 In order to utilise the services of retired persons for the development of fruit industry and to enable them to lead a useful and productive life in the rural area, it will be desirable to start co-operative garden colony scheme on the lines adopted in the Punjab.

5.24 There is said to be a considerable area of culturable waste land in both the States, which requires to be reclaimed. The States may lease out these areas to progressive enterprising agriculturists for sufficiently long period or (b) start cooperative farm on these areas to see to what extent, even under favourable conditions, cooperative farming can be a success.

5.25 *Soil erosion*.—This is a most serious problem in both the States. In Rajasthan no less than 30 per cent of the total culturable area has already been devastated by soil erosion—gullies, ravines, rills & even sheet

erosion. Since the problem of soil erosion is not directly concerned with Chambal Valley Project, the subject is proposed to be separately discussed, except that sheet erosion (although imperceptible to an untrained eye) goes on continuously washing away fertile soil from land that appear almost level or only slightly sloping; and this evil is likely to be accentuated with the advent of canal system. It will be the duty of Irrigation and Agriculture Departments to popularize agricultural practices like contour cultivation, strip cropping, terracing, levelling, proper crop rotation, bunding etc.

5.26 Estimates of expenditure for three years both recurring and non recurring on various schemes proposed, aggregates to Rs. 59·3 lakhs for Rajasthan and Rs. 57 lakhs for Madhya Pradesh including the amounts recoverable from cultivators. Details of expenditure and proceedings of meetings held with State authorities are given in the Appendices.

5.27 *Incentive for development.*—Some of the land to be brought under irrigation needs considerable improvement by way of clearance of *ber* bushes and levelling of steep slopes and ravines, requiring time and capital. In the interest of expediting development of irrigation, it is recommended that relatively bigger holdings may be entrusted to private enterprise and ceiling of ownership of land may not be applied for a period of say 25 years. With persistent effort on all hands the period of development may be reduced to 5 years instead of 10 provided in the Project report.

5.28 *Betterment levy.*—In view of the increasing value of lands consequent upon availability of irrigation facilities the necessity of a betterment levy is beyond any doubt. The main principle to be followed should be that the betterment levy may be half of the estimated increase in the value of land as a result of the benefits of irrigation. It is learnt that necessary legislation in this regard is under consideration of Madhya Pradesh and Rajasthan Government.

VI—Power Generation

6.1 Owing to the present financial difficulties in the country, the load growth in the Chambal region will not be as rapid (increasing five-fold in five years) as it was forecast earlier. Hence it is suggested that foreign exchange expenditure on Rana Pratap Sagar Power Plant may be postponed but the civil works should be started in the Second Plan period. The works could be accelerated if any unforeseen development of new loads does come about earlier than now considered probable.

6.2 The proposed transmission system lay-out may be modified slightly so as to inter-connect with the Chambal grid the recently installed thermal power plants and those under erection presently, contributing an effective capacity of 34,000 KW.

6.3 At the Gandhi Sagar Power Station, the 5th generating unit for which the penstock pipe has already been provided in the dam, may be

installed. With this installation and in conjunction with the thermal plants, it is possible to meet a system demand upto 1,20,000 KW. The addition of the 5th unit not only serves to meet the load demand in the interim period till additional hydro-capacity is commissioned in the region, but also provides spare generating capacity for all the 3 hydro-stations, namely, Gandhi Sagar, Rana Pratap Sagar and Kotah in the ultimate stage.

6.4 By the integrated operation of the Gandhi Sagar Station with the new thermal plants, more thermal generation than now may be necessary but it is possible to minimize it. To begin with, irrigation would not have fully developed. Also, in the early stages of load development, the system load factor will be lower than 60 per cent and it may be possible to meet the entire load demand by operating 5 units at Gandhi Sagar Power Station only. As the system load grows and load factor improves, thermal support could be brought in gradually. Prior to full irrigation development, keeping the reservoir full (R.L. 1312) at the end of the Monsoon on 1st October and by drawing down the reservoir to as low a level as possible by the end of June and building it up during the Monsoon, it is possible to generate maximum hydro energy. In a good year, there will be no need for thermal generation at all except for about an hour or so per day to meet the peak demand. In years of average or low rainfall it would be necessary to supplement the hydro energy by thermal generation. It is expected that the average coal consumption per annum may not exceed what it would be, say in 1958.

6.5 Another advantage of the integrated operation would be the improvement in the performance of the unusually extensive (about 1,000 miles) transmission net-work associated with this Project which has an ultimate hydro potential of about 2,00,000 KW in the 3 hydro stations. Normally in a well-developed region this quantum of power would be absorbed in a distance of about 200 miles. It is suggested that the performance of the proposed transmission system may be studied on the Network Analyser at the Indian Institute of Science, Bangalore. Based on the results of this study, the design and the lay-out of the transmission system may be suitably modified.

6.6 With a view to economise in the use of steel, the possibility of utilising wood-poles or concrete poles for transmission lines of 66 KV and below may be examined.

6.7 The major handicap for the speedy execution of the electrical works appears to be the shortage of technical personnel. It is suggested that the C.W. & P.C. may consider sparing for this Project some officers who, being familiar with the designs, could be of help to accelerate executions in the field.

6.8 For deriving early and maximum benefits from the sale of power that will be developed by the Chambal Project in successive stages of its

construction, it is essential that the State Electricity Boards of Madhya Pradesh and Rajasthan should co-operate very closely and plan on the full utilisation of the hydro power as it becomes available, based on short term power sales understandings between the two Electricity Boards. Power should be utilised fully by whichever administration is ready to do so and the programme should not be impeded by a literal interpretation of the Agreement that the power available should be shared equally between Madhya Pradesh and Rajasthan. Power may be made available for all consumers who can make effective use of it irrespective of where they are whether in Madhya Pradesh or in Rajasthan. Such a load-building programme will keep the total power generating facilities fully loaded all the time and will facilitate early and profitable construction of the Rana Pratap Sagar Power Station and other Power Stations down below.

VII—Works Needing Urgent Attention

7.1 The progress on transmission lines both in Madhya Pradesh and Rajasthan is almost negligible. Special attention is necessary both as regards procurement of materials and erection so as to obtain the benefits of power soon after the power plant is ready for operation in 1959.

7.2 The Kotah Barrage including erection of gates has to be completed by 1959. Up till now progress on earthen dam portion of the barrage is practically nil. In order to complete the same by June 1959, very special efforts and care are necessary in providing the filters, clay grouting of foundation, and placing of bleeder wells. A very careful schedule is considered imperative in view of the necessity to complete all the foundation works before the commencement of coming Monsoon, and the entire earth work, during the next working season before the Monsoon of 1959.

7.3 The radial gates on the spillway are required to be fabricated and erected in position before the irrigation season of 1959 commences. Already some delay has taken place due to non-availability of steel in time. The Control Board should arrange for necessary agency to watch the progress of all the works at various stages and schedules attained.

7.4 Progress on all the cross drainage works on canals have to be specifically watched so that they are completed before the irrigation commences in their respective zones. The numerous railway crossings need specially attended to as they are to be constructed by railway authorities.

7.5 Field channels and water-courses need to be completed before the irrigation starts in respective zones.

VIII.—Cost of Project

8.1. Total development of the scheme with all three dams, power houses and transmission lines, Kotah Barrage and canals system was originally estimated to cost Rs. 77 crores. Out of this, the Gandhi Sagar Dam and its power houses, transmission lines, Kotah Barrage and the canal system intended to be completed up to the end of Second Five Year Plan originally

estimated to cost Rs. 48·03 crores are now revised to Rs. 63·59 crores, in view of rising costs and increase in quantities etc.

8.2 The expenditure upto date is Rs. 14·62 crores.

8.3 The Team has proposed economies amounting to a crore of rupees, by way of (a) dovetailing construction of Rana Pratap Sagar Dam with that of Gandhi Sagar Dam, (b) accelerating canal construction, and (c) lining canals with lime concrete instead of cement concrete etc.



LIST OF APPENDICES*

- I. Index Plan and Salient Features; Abstract of estimated Costs.
- VI-A. Possible economies in the item of lining on rock cut reaches—Right Bank Canal (Madhya Pradesh).
- VI-B. Probable economies in establishment charges due to proposed acceleration of construction of canals.
- IX. Abstract of suggested Economies.
- XI-D. Map of Chambal Transmission System.
- XI-E. Programme of Construction of Chambal Transmission System.
- XV. Proceedings of meeting at Bhopal, dated 23-7-57.
- XVII. Proceedings of meeting held on 11-9-57 at Bhopal.
- XVIII. Letter from Chief Engineer (Irrigation), Madhya Pradesh to Shri Lal Singh and report of Dy. Chief Engineer:
- XIX. Proceedings and meeting at Jaipur with Agricultural Authorities, Rajasthan.
- XIX-A. Minutes of meeting with Minister for Agriculture, Government of Rajasthan.
- XX. Minutes of meeting with representatives of Rajasthan Government, dated 15th September 1957 in New Delhi.
- XX-A. Record of discussions of meeting between Shri Lal Singh and Representatives of Rajasthan Government at Technical Level on 15th September 1957.
- XXI. & } Summary of expenditure for Agricultural Schemes.
XXI-A. }
- XXI-B Letter from Vice-President I.C.A.R. to Secretary, Committee on Plan Projects.

*All the Appendices mentioned in the Report have been supplied to the State Governments concerned and also to the Irrigation & Power Ministry. The rest of the Appendices not added to the Report are available in the Office of the COPP.

APPENDIX I

CHAMBAL VALLEY DEVELOPMENT SALIENT FEATURES

I—STORAGE RESERVOIRS

A—Gandhi Sagar

1. Site of Dam	On the River Chambal, 19 miles N.W. of Bhanpura and 5 miles downstream of the mouth of gorge on the boundary of Madhya Pradesh and Rajasthan. Nearest Railway Station-Jhalawar Road on Broad Gauge-Bombay-Delhi line (Western Rly.) 32 miles by road from the Dam site.			
2. Catchment area	8,700 square miles.			
3. Rainfall	(a) Maximum rainfall — 52 inches (1944). (b) Average annual rainfall — 34 inches for a period of 47 years.			
4. Run-off	(a) Maximum (in 1944) — 9.522 Million acre ft. (b) Minimum (in 1918) — 0.828 Million acre ft. (c) Average of 47 years — 3.680 Million acre ft.			
5. Flood flow	(a) Maximum observed — 6,41,000 cusecs (b) Maximum design flood — 7,50,000 cusecs (c) Moderated flood adopted for design of Dam — 4,50,000 cusecs.			
6. Dam.				
(i) Type	Straight Gravity.			
(ii) Profile :	Non-over flow section	Over-flow section	Power section	Sluice section
	1	2	3	4
(a) Maximum width at top	21 ft.	..	30 ft.	38.5 ft.
(b) Maximum width at bottom	164.2 ft.	175.8 ft.	164.2 ft.	175.8 ft.
(c) Maximum height above foundations	202 ft.	169 ft.	202 ft.	207 ft.
(d) Length of the Dam	(i) at top (R.L. 1322) between the bank 1680 feet. (ii) at bed (R.L. 1120) 1250 feet.			
(e) Area submerged	(i) at F.R.L. & M.W.L. (R.L. 1312) 223 sq. miles or 1,42,720 acres. (ii) at Minimum Draw off level (R.L. 1250) 50 sq. miles.			
Contents of Dam	27 Million cubic feet of Stone Masonry in red cement mortar and cement concrete around openings.			

7. Flood disposal

- (a) Over the Dam . Spillway controlled by 10 crest gates 60' x 28' each... Crest level 1284.00.

(b) Through the Dam . 9 high level sluices 10' x 25' each, Sill level 1193.50.

8. Reservoir levels

(i) Average bed level of river	R.L.	1120·0
(ii) Road on top	R.L.	1322·0
(iii) Top of parapet	R.L.	1326·0
(iv) Crest of weir	R.L.	1284·0
(v) Full reservoir level	R.L.	1312·0
(vi) Maximum water level	R.L.	1312·0
(vii) Dead storage level	R.L.	1250·0

9. Storage capacity

(a) Gross storage	.		.	6.7 million acre ft.
(b) Live storage	.		.	6.04 million acre ft.
(c) Dead storage	.		.	0.66 million acre ft.

B—Rana Pratap Sagar Dam at Rawatbhatta

- | | |
|-------------------|---|
| 1. Site of Dam | On the river Chambal 20 miles below Gandhi Sagar & 32 miles South of Kotah City. The nearest Railway Station is Kotah Junction on the Bombay Delhi Broad Gauge Line of the Western Railway. |
| 2. Catchment area | 9,600 square miles. Below the Gandhi Sagar Dam—900 square miles. |
| 3. Rainfall | (a) Maximum Rainfall — 52 inches (observed in 1944).
(b) Average of 47 years — 32 inches. |
| 4. Run-off | From the total catchment of 9,600 sq. miles.
(a) Maximum in 1946 — 10.97 million acre ft.
(b) Minimum in 1918 — 0.77 acre ft.
(c) Average of 47 years — 4.015 million acre ft. |
| 5. Flood flow | (a) Maximum observed at Kotah — 8,60,000 cusecs.
(b) Maximum design flood — 7,92,000 cusecs.
(c) Moderated flood adopted for design — 6,60,000 cusecs. |

6. Dams

(i) Type Gravity type. Open spillway (with crest gates)

		Non-over flow section	Over-flow Section	Power	Sluices
(ii) Profile:					
(a) Front slope		I:20	I:20	I:20	I:20
(b) Rear slope		0.75:I	0.7:I	0.75:I	0.85:I
(c) Maximum height above foundations		127 ft.	90 ft.	127.5 ft.	127.5 ft.
(d) Maximum height above bed		122.5 ft.	85 ft.	122.5 ft.	122.5 ft.
(e) Length of the Dam:					
(i) at top		3,620 feet (including			
(ii) at bed		2,000 feet, earthern Dam).			
width at top		18 ft.		30 ft.	
width at bottom		85 ft.	94.5 ft.	76.5 ft.	29 ft.
Area submerged					97 ft.
at F.R.L. and M.W.L.		76.5 sq. miles, or 48960 acres.			
(R.L. 1157.50).					

7. Contents of the Dam

- (a) Quantity of masonry 13.26 million cubic ft. stone masonry in red cement mortar.
 (b) Quantity of earth work 5.40 million cubic feet.

8. Flood disposal

- Over the Dam spillway 27 vents controlled by crest gates 50' × 30' each.
 Through the Dam Two under sluices 10' × 20' each.

9. Reservoir levels:-

- (i) Average bed level R. L. 1042.50
 (ii) Road on top R. L. 1162.50
 (iii) Top of parapet R. L. 1165.00
 (iv) Crest of weir R. L. 1127.50
 (v) Full reservoir level R. L. 1157.50
 (vi) Maximum water level R. L. 1157.50
 (vii) Dead storage level R. L. 1102.50

10. Storage capacity

- (a) Gross storage 2.35 million acre ft.
 (b) Live storage 1.73 million acre ft.
 (c) Dead storage 0.62 million acre ft.

C. Saddle Dam

1. Site of Dam On the River Chambal Lat. 24° 53' Long. 75° 34' East, two miles up stream of the main Dam.
 2. (a) Type Composite Dam—Masonry facing, with earth backing.
 (b) Profile Non-over flow.
 (i) Front face I:10
 (ii) Rear face Face wall 4:10
 Earth backing 2:1

(c) Width at top	13 ft.
(d) Width at bottom	29 feet (masonry wall) 130 feet (earth backing)
(e) Maximum height above bed	65 feet (excluding parapet)
(f) Maximum height above foundations	80 feet (masonry wall)
(g) Length of Dam : (i) At top	1050 ft.
(ii) At F. R. L. & M.W.L.	1000 ft.
(iii) At bed	300 ft.
3. Materials used for construction.	Uncoursed stone masonry in lime Surkhi Mortar (1:3) with 1'-6" thick course (1:4) in the up-stream face, flush pointed,
4. Contents of the DAM.	0.70 million cubic ft. masonry. 1.81 million cubic feet earth.
5. Levels	
(a) Average bed level	R. L. 1097.50
(b) Top of parapet	R. L. 1165.00
(c) Earth backing (top level)	R. L. 1162.50
(d) Full reservoir level	R. L. 1157.50
(e) Maximum water level	R. L. 1157.50

D—Kotah Barrage.

1. Site of Barrage	On the River Chambal $\frac{1}{2}$ mile upstream of Kotah city. The nearest Railway Station is Kotah Junction on the Bombay-Delhi Broad Gauge line of the Western Railway.
2. Catchment area	10,500 square miles—900 square miles below Rana Pratap Sagar Dam and 1800 sq miles below Gandhi Sagar.
3. Rainfall :	
(a) Maximum observed (in 1944)	52 inches.
(b) Average of 47 years.	32 inches.
4. Run-off:	
(a) Maximum in 1944.	11.500 million acre ft.
(b) Minimum in 1918	1.002 million acre ft.
(c) Average of 47 years.	4.417 million acre ft.
5. Flood flow :	
(a) Maximum observed	8,80,000 cusecs.
(b) Moderated	7,50,000 „ (Due to Gandhi Sagar and Rana Pratap Sagar Dams).
6. Barrage :	
(i) Type	Earthen in the pool portion and masonry with 16 gates 50' \times 40' on the left flank with suitable retaining wall in between.

(ii) Profile for earthen section

(a)	Front	3 : 1
(b)	Rear	2.5 : 1
(iii)	width at top	26 feet (at crest)
(iv)	Maximum width at bottom.	711 feet at R.L. 740.00
(v)	Maximum height above left flank rocky bed	50 feet upto crest and 100 feet upto operating platform and road.
(vi)	Maximum height above foundations	120 feet.
(vii)	Length of Dam	(a) at top 1,970 feet. (b) At bed in pool portion 500 ft.
(viii)	Material used for construction.	Rock for toes from sand stone on left flank. Body of earthen section from silt bank of left side.

(ix) Contents of Dam

(a)	Masonry	19.5 lakh cft.
(b)	Concrete	23.0 lakh cft.
(c)	Earth	170.0 lakh cft.
(d)	Rock cutting	81.0 lackh cft.

(As per Project Report)

7. Flood Disposal

(a)	Over the Dam: 16 vents of 50' x 40' for a moderated discharge of 7.5 lakh cusecs.
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8. Barrage levels

(a)	Average bed level of river	R.L. 746.00 in pool portion.
(b)	Road on top	R.L. 862.50
(c)	Top of platform	R.L. 872.00
(d)	Crest of weir	R.L. 812.00
(e)	Full lake level	R.L. 852.00
(f)	Maximum water level	R.L. 856.00

II—IRRIGATION

1.	(a) Gross commanded area acres	28.84 lakh.
	(b) Culturable commanded area acres	19.45 lakh.
	(c) Annual irrigation-acres	14.0 lakh.
	(d) Duty of water at Head Works	6 cusecs per 1000 acres of annual irrigation.
2.	Length of Canals	
	(a) Right Main Canal	232 miles.
	(b) Left Main Canal	2 miles.
3.	Discharges at head of the canal	
	(a) Right Main Canal at head	6840 Cusecs.
	(b) Parbati Crossing (M.B. State)	3900 Cusecs.
	(c) Left Main Canal	1560 Cusecs.

III—POWER

A—Gandhi Sagar

1. Levels:

1.	Full reservoir level	R.L. 1312.0
2.	Lowest draw-off level	R.L. 1250.0
3.	Normal tail water level	R.L. 1125.0
4.	Highest tail water level	R.L. 1160.0
5.	Power Station floor level	R.L. 1175.0
6.	Penstock inlet centres	R.L. 1205.0

2. Penstocks :

(a) Diameter	15'—6"
(b) Material	Steel.

3. Head:

1.	Maximum	187 feet.
2.	Minimum	125 feet.

4. Power Station:

1.	Installed capacity	4 units of 23,000 KW each with provision for one more unit at a later stage.
2.	Firm power generated.	
	(a) at 100% load factor	45,000 KW.
	(b) at 60% load factor	75,000 KW.

B—Rana Pratap Sagar

1. Levels:

1.	Full Reservoir level	R.L. 1157.5
2.	Lowest draw-off level	R.L. 1107.5
3.	Normal tail water level	R.L. 975.5
4.	Highest tail water level	R.L. 1018.0
5.	Power Station floor level	R.L. 1025.0
6.	Penstock inlet centres	R.L. 1087.5

2. Head:

(i)	Maximum	182 feet.
(ii)	Minimum	132 feet.

3. Power Station:

1.	Installed capacity	3 units of 28,000 KW each.
2.	Power generated.	
	(a) at 100% load factor	54,000 KW.
	(b) at 60% load factor	90,000 KW.

C—Kotah Dam

Not yet finalised. Will be taken in last stage

IV—FINANCIAL ASPECT (COSTS & REVENUE)

First Stage of Development (As per Project Report).

A. Costs	Rs. in lakhs.
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1. Gandhi Sagar Dam	890
2. Rana Pratap Sagar Dam	366
3. Kotah Barrage	307
4. Canals	2252
5. Gandhi Sagar Power Station	500
6. Transmission System	854

TOTAL	5169
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7. Total sum-at-charge including interest at 4½% in the 12th year	5650.11
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B. Revenue (Gross)

1. Irrigation 1.4 million acres @ Rs. 9/9/- per acre	133.88
2. Power 75,000 KW. @ Rs. 235/- per KW.	176.25

TOTAL	310.13
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Charges :

1. Irrigation (Maintenance and collection) (Rs. 2/- per acre per year for 1.4 million acres)	28.00
2. Headworks (maintenance Charges @ 1%)	15.42
3. Power (Operation, maintenance & depreciation @ 3½%)	46.69

TOTAL CHARGES	90.11
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Revenue (Net)	220.02
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C. Net return on sum-at-charge in the 5th year after completion of the 1st year 1st stage	4.28%
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D. Final Stage Development :

The net return on the sum-at-charge when the scheme is completed, is expected to be nearly 7.55%

APPENDIX 1

Abstract of Estimated Costs

Sl.	Name of work	Amount	Remarks
(In Lakhs of rupees)			
1	Gandhi Sagar Dam		
	Dam and appurtenant works . .	890	
2	Gandhi Sagar Power Station . .	500	
3	Transmission System . .		
	(a) Madhya Pradesh . .	449	
	(b) Rajasthan . .	405	
4	Rana Pratap Sagar Dam . .		
	Dam and appurtenant works . .	584.15	
5	Hydro-Electric Installation . .	764.5	
6	Transmission . .	417.53	
7	Kotah Barrage . .	307	
8	Left Main Canal (Rajasthan) . .	186	
9	Right Main Canal (Rajasthan) . .	762	
10	Right Main Canal (Madhya Pradesh) . .	1304	
TOTAL . .		Rs. 6569.18 Lakhs	

Note :—

Madhya Pradesh Portion Rs. 3143 Lakhs
 Rajasthan Portion Rs. 3426.18 Lakhs

APPENDIX VI-A

Possible economies in the item of lining in rock-cut reaches Right Bank Canal (Madhya Pradesh)

As a result of detailed studies and discussions with the Chief Engineer, Chambal Project, Madhya Pradesh, the following conclusions have been arrived:—

1. There is no objection to delete the provision of plastering the sides of canal in rock-cut reaches. Pointing may prove enough.
2. In some test sections, bed lining may be omitted.
3. Where possible the width between side walls may be increased to provide water-way without lining. The rugosity co-efficient may be thus kept on the safe-side.
4. Alternatives of the above nature might be brought in during the course of construction in order to secure economy.

It is expected that there will be a period of 5 to 6 years before the canal will run full supply. Thus for this period there will be no risk for inadequate capacity in the Canal.

The omission of the 1" thick mortar on the sides has been suggested because such thick mortar even if applied is likely to crack due to differential shrinkage and thus lose its objective.

In the bed, the heavily pitted section might be made up by ramming of spawls and ballast prepared to suitable consistency with lime mortar thus saving cement which is a critically short material and also saving some cost.

The use of rubble masonry in the form of chip masonry as is practised on the Lakkavalli Project is recommended.

The provision of side walls in stone masonry is considered obligatory from the overall point of view of safety.

Wherever possible the bed width of the canal is recommended to be made 55 to 60 ft. rather than 45 ft. with lining. The actual economies will need to be taken into account for each section because the depth of cutting varies.

The data in respect of each reach where lining has to be done is not yet available. Under the circumstances, only the rough estimation of the probable saving can be made. This is given below:

1. Over the estimates of Rs. 35 lakhs that are being sanctioned for lining a saving of Rs. 12 lakhs has been calculated if the bed lining and plaster are altogether altered and the side walls are done in rubble masonry.

2. If cement is substituted by Kankar lime, then an economy of about Rs. 6 lakhs is anticipated.

In both cases, side walls have been allowed for as their construction appears obligatory. Some small savings can be had under this by the adoption of chip masonry rather than rubble masonry.

The above saving of Rs. 12 lakhs and Rs. 6 lakhs have been computed with regard to the sanctioned estimate of Rs. 35 lakhs. On the average, if the two methods are combined according to the site conditions, it will be reasonable to assume a saving of about Rs. 9 lakhs. If the same saving is applied *pro-rata* to the total expected cost of Rs. 75 lakhs, the total saving will be of the order of Rs. 20 lakhs.

P.S.—The total estimated cost of lining in rock cut reaches is now figured at Rs. 1·08 crores (*vide* Chief Engineer's letter enclosed).

Extract of Note on Observations by Shri A. K. Char, Chief Engineer,

Chambal Hydel Project.

Lining of Canal

Capt. III, Para 1.4.—The work of lining of canal in rock reaches is expected to cost Rs. 75 lakhs but the Project provision is about Rs. 35 lakhs.

Chief Engineer is in agreement, as follows:—

- (i) No objection to delete plastering—*Pointing may be enough.*
- (ii) In some test sections, he will omit bed lining.
- (iii) The width between side-walls, where possible, will be increased to provide waterway without lining.
- (iv) Generally speaking, he is himself in favour of securing economies by bringing alternatives.

Chief Engineer is of the view that, as there will be period of 5 to 6 years before the canal has to run with full supply, there will be no risk of loss of capacity for this period.

OFFICE OF THE CHIEF ENGINEER

D.O. No. 26801

CHAMBAL HYDEL & IRRIGATION SCHEME,
MADHYA BHARAT

P. O. Chambal Hydel Works

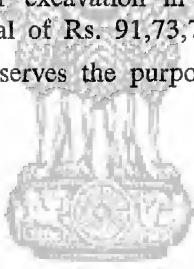
Dated 25th September, 1957

MY DEAR SHRI BORKER,

As desired by you in your D. O. letter No. COPP/I&P/8/57 dated 17th September, 1957, I am enclosing herewith a statement of rocky reaches of Right Main Canal of M.P. portion, where lining is proposed to be done. The rocky reaches given in the statement are as per the final—alignment of the Main Canal on which the work is now taken up. Column 7 in the statement gives the estimated cost of earth work and rock cut in these reaches, and column 8 gives the cost of lining of these rocky reaches. The total cost of earth work, rock cut and lining of the Canal in these reaches is now estimated to be about—Rs. 1,61,45,000 as against the provision of Rs. 56,73,780 for excavation in rock and Rs. 35,00,000 for lining of the Canal or a total of Rs. 91,73,780.

I hope this information serves the purpose.

Encl: 1 Statement



Yours sincerely,

Sd/- (A. K. Char)

Shri D. S. Borke
Secretary,
Consultative Committee
on Irrigation & Power Projects,
New Delhi.

STATEMENT SHOWING THE QUANTITIES AND AMOUNT OF SANCTIONED ESTIMATE FOR ROCKY REACHES IN RIGHT
MAIN CANAL UPPER (MADHYA PRADESH)

Mile No.	Rocky Reach Chainage	Total Chainage	Qty. of earth cut in C. Ft.	Qty. of rock cut in C. Ft.	Total amount of earth work and rock cut in C. Ft.	Cost of lining of canal	Remarks
From	To						
1	2	3	4	5	6	7	8
							9

							Rs.	Rs.
36	1795	1800	6 ch	2,63,300	83,200	21,040	3,77,380	As per sanctioned estm.
37	1801	1845.4	45.4 ch	8,05,200	13,19,100	2,47,095	..	L.S.
38	1851	1903	50 ch	6,96,969	9,89,847	4,40,720	5,00,000	
40	2263	2300	38 ch	1,33,600	4,55,300	83,042	4,46,800	
47	2301	2350	50 ch	1,48,100	1,87,300	39,069	7,83,380	
48	2351	2400	50 ch	3,67,700	4,86,600	95,347	6,04,870	
49	2401	2450	50 ch	4,02,300	9,37,100	1,71,667	5,04,870	As per sanctioned estimate.
50	2451	2500	50 ch	3,25,800	10,92,900	1,95,92	4,82,800	
51	2501	2544.3	44.3 ch	2,73,700	11,39,500	2,01,837	4,54,100	
55	2721	2748	28 ch	14,36,200	9,08,500	1,97,700	2,80,000	
58	2895	2900	6 ch	2,86,100	68,884	28,635	60,000	
59	2901	2950	50 ch	8,47,600	5,68,300	1,20,160	5,00,000	
60	2951	3000	50 ch	5,89,200	6,71,200	1,30,070	5,00,000	

For lining, provision has been made taking Rs. 5 lakhs per miles of 50 ch.

61	3001	3021	41 ch	II, 65,200	6,72,100	I, 46,130	4,10,000
	3034	3043	14 ch	18,27,200	7,68,600	1,92,540	1,14,000
63	3137	3150	9 ch	3,49,800	5,94,200	1,11,750	90,000
64	3151	3159	12 ch	5,90,100	4,99,600	1,05,980	1,20,000
65	3239	3250	11 ch	3,82,500	4,48,800	95,660	1,10,000
66	3251	3258					
	3268	3273					
70	3471	3485	15 ch	8,57,800	9,19,800	1,82,170	1,50,000
71	3536	3540	5 ch	1,13,600	84,300	21,620	50,000
72	3594	3600	7 ch	91,300	1,22,300	24,630	70,000
73	3601	3650	50 ch	2,93,800	9,52,700	1,69,240	50,000
74	3651	3654	4 ch	52,800	77,900	20,720	40,000
76	3760	3800	41 ch	3,38,700	8,30,200	1,51,960	4,10,000
77	3801	3832	32 ch	2,49,100	8,75,200	1,55,060	3,20,000
78	3875	3900	26 ch	1,50,800	6,32,100	1,12,440	2,60,000
79	3901	3938	38 ch	5,01,200	5,74,300	1,15,650	3,80,000
82	4060	4066	11 ch	4,90,400	1,34,000	36,530	1,10,000
	4073	4076					
84	4177	4185-92	9-92 ch	2,10,100	2,38,800	4,7,620	99,200
85	4201	4252-89	52-89 ch	19,38,100	45,32,900	8,75,280	5,28,500
98	4851	4900	50 ch	26,79,000	2,71,800	1,79,390	5,00,000
99	4901	4950	50 ch	4,72,000	9,11,700	,82,1950	5,00,000
100	4951	5000	50 ch	10,11,500	11,15,500	2,37,40	5,00,000
101	5001	5050	50 ch	4,11,000	10,22,900	2,02,270	5,00,000
	GRAND TOTAL		1096.51 ch	2,06,96,789	2,51,92,431	53,38,744	1,08,66,280
			C. Ft.				

Total cost for earthwork, rock-cut and lining—Rs. 1, 61,45,000/-

L. S. provision for lining has been made taking Rs. 5 lakhs per mile of 50 ch. in account.

Sd/^r (A. K. CHAR)
Chief Engineer,
Chambal Hydel and Irrigation Scheme, Madhya Pradesh, 24-9-57.

APPENDIX VI-B

Probable Economies in Establishment Charges due to proposed acceleration of construction of Canals.

The provision for Establishment is based as 11 per cent and 7 per cent of the provision for canals in the original estimate respectively for Rajasthan and Madhya Pradesh.

Rajasthan.—Right Main Canal

Provision.—52.21 lakhs.

The work is scheduled to be completed by 1961-62. It is now proposed to accelerate and complete it by 1960-61 i.e. one year ahead.

Work was started in 1953-54. Therefore number of years for completion was to be 8 years but now it will be 7 years.

Therefore economies on this basis will be $1/8 \times 52.21 = 6.52$ say Rs. 6 lakhs.

Allowing for continuance of partial staff for settlement of claims etc. to the extent of Rs. 1 lakh, net savings will be Rs. 5 lakhs.

MADHYA PRADESH.—Right Main Canal.

Provision is Rs. 84,51,853

Period of construction— 10 years starting from 1953-54, ending 1962-63.

It is proposed to accelerate and complete it by 1960-1961.

The reduced establishment charges will, according to this, be $84,51,853 \times 0.7 = 59,16,297.1$.

Therefore savings will be 24,88,882.

Allowing for settlement of claims and balance of works Rs. 5 lakhs, net savings will be approximately Rs. 20 lakhs.

The total economies on this sub head will be Rs. 5.20 or 25 lakhs.

It is expected that the works get completed and certain staff is to be reduced the technical personnel will either be absorbed in the service of the States or on other major projects.

APPENDIX IX

ABSTRACT OF SUGGESTED ECONOMIES

As a result of studies and discussions with Chief Engineers, the following agreed conclusions have been reached.

1. *Rana Pratap Sagar Dam*.—The machinery and equipment which will become available from the Gandhi Sagar Dam construction and Kotah Barrage and other works can certainly be utilized for Rana Pratap Sagar. The dovetailing of the work of Rana Pratap Sagar Dam with that of Gandhi Sagar Dam will unquestionably lead to economy in construction, besides greater efficiency.

Economies that will become possible by such implementation are:

(i) Buildings	Rs. 32 lakhs.
(ii) Establishment	Rs. 11 lakhs.
(iii) Machinery and equipment	Rs. 11 lakhs.
TOTAL	Rs. 54 lakhs.

Note:—Depending upon detailed construction plant layout, the economy under machinery and equipment is expected to be about Rs. 25 lakhs. However, the figure of Rs. 11 lakhs has been adopted to remain on the conservative side, in case the job is not as much mechanized as Gandhi Sagar Dam.

2. *Acceleration of Canal Construction*.—Chief Engineer, Chambal, Madhya Pradesh, is in full agreement that acceleration of this work is possible if the organization is strengthened. Already earthwork has been in excess of the target both for machinery and manual labour. Other difficulties are not regarded insurmountable. Availability of necessary funds is, however, essential.

Savings under this sub-head have been taken into account for establishment only. The amount estimated is Rs. 25 lakhs.

3. *Lining of Canals in rock cut reaches Madhya Pradesh*.—Chief Engineer, Madhya Pradesh, has agreed to the suggestion made by the Team for simplification of the specifications of lining depending on the nature of the various reaches.

The modifications include omitting of plastering and of bed lining in certain reaches. Widening of the Canal has also been suggested where economically feasible. Side walls are to remain as per estimate. An economy of about Rs. 20 lakhs is expected.

Abstract:—

1. Rana Pratap Sagar	..	..	Rs. 54 lakhs.
2. Acceleration	..	..	Rs. 25 lakhs.
3. Lining in rockcut reaches	..	..	Rs. 20 lakhs.
Total	..	..	Rs. 99 lakhs. or Approximately Rs. 1 crore.



APPENDIX XI.—E
Programme of Construction of Chambal Transmission system as on October 1957

Particulars	Voltage and No. of circuits	Distance miles	Status about line materials			Scheduled date for completion	Present status regarding erection
			Towers	Conductors	Insulators		
MADHYA PRADESH							
1. Gandhi Sagar-Ujjain	132 KV, d/c	118	Ordered	Ordered	Ordered	May	1959
2. Ujjain-Indore	66 KV, d/c	32	Do.	Do.	Do.	August	1958
3. Ujjain-Bhopal	132 KV, s/c	116	Do.	Do.	Do.	March	1960
4. Ujjain-Nagda-Ratlam	66 KV, s/c	62	Do.	Do.	Do.	July	1959
5. Gandhi Sagar-Neemuch	132 KV, s/c	47	Do.	to be ordered soon	Do.	Do.	1959
6. Neemuch-Mandsaur	66 KV, s/c	29	Do.	Do.	Do.	March	1959
7. Sawaimadhopur-Gwalior Grid Substation equipment :	132 KV, d/c	116	Do.	Do.	Do.	July	1960
			Tenders due on 1-10-57			Tentative date for commissioning May 1960.	
RAJASTHAN							
1. Gandhi Sagar-Kotah-Sawaimadhopur	132 KV, d/c	115	Tenders due on 30-9-57	100	75	120	Revised Tenders due 18-10-57
2. Sawaimadhopur-Jaipur	132 KV, s/c	75					
3. Kotah-Aimer	132 KV, s/c	120					
4. Neemuch-Udaipur-Zawar	132 KV, s/c	100					
5. Neemuch-Chittor-Bhilwara	66 KV, s/c	75	Specifications ready: enquiries to be issued.				

APPENDIX XV

CHAMBAL VALLEY PROJECT—AGRICULTURAL ASPECT

Proceedings of the Meeting held by Shri N. V. Gadgil, Leader of Irrigation and Power Team of the COPP at the Raj Bhawan, Bhopal on the 23rd July, 1957. The following were present:—

1. Shri N. V. Gadgil, Leader I.P.T.
 2. Sardar Lal Singh, Member I.P.T.
 3. Shri Takhatmal Jain, Minister for Industries (Agriculture).
 4. Secretary to Government Agriculture Department (M.P.).
 5. Director of Agriculture (M.P.).
 6. Joint Director of Agriculture (Extension) M.P.
 7. Joint Director of Agriculture (Research) M.P.
 8. Dy. Director of Agriculture, Gwalior Division, M.P.
2. The summary report on the agricultural aspect of the Chambal Valley Project prepared by Sardar Lal Singh Ex-Director of Agriculture, Punjab was discussed at length. Before this, the report was discussed at the officers level and also subsequently with the Minister for Agriculture (M.P.), at his residence, where some M.L.As., of Madhya Pradesh were also present.
3. There was general agreement on all the recommendations made in Sardar Lal Singh's report. In particular, the aspects mentioned hereunder were emphasized.
4. It was agreed unanimously that the economic success of Chambal Valley Project will depend upon the extent to which the agricultural problems referred to in the report are solved. Unless precautions are taken to avoid the anticipated dangers and experimental work is done to find answers to the questions that will arise with the advent of canal irrigation, the canal irrigation may not only be as beneficial a proposition as is expected, but may in fact even prove a curse in certain areas by bringing about water-logging or creating alkalinity problems or hastening soil erosion.
5. The cultivating community in the area concerned largely is accustomed to dry farming which is entirely different from that of wet farming, in so far as the varieties of crops or the agricultural practices are concerned and people will have to be trained in the proper use of canal water.
6. It was agreed that the urgent experiments to be conducted should include (a) varietal trials on all important crops particularly wheat, cotton, sugarcane and paddy in order to determine the varieties best suited under

irrigated conditions (b) cultural experiments such as seed-rate, manures, rotation, spacing, green-manuring as all these have tremendous effect on the yields of crops. For the above experiments necessary area of land is already available on three Government farms of 100 acres each, which have been started recently with the same object at Sheopur (Baroda), Jora and Bhind. At all these places irrigation water by well irrigation is already available. At Bhind the water level being very low, experimental work during the initial two or three days may have to be done at Chimka Agricultural School where some area is already available and more can be acquired. As soon as canal water becomes available, most of the experimental work can be shifted to Bhind farm.

7. The experiments requiring collection of detailed data will necessarily have to be conducted at the above government farms. The total amount of expenditure required will be of the order of Rs. 25,000, for each farm per year in addition to the provisions already made or a total of about Rs. 75,000 per year for three Chambal farms. In addition to the experiments on Government farms a considerable amount of experimental-cum-demonstration work must be undertaken on cultivators' private farms, firstly to confirm the results obtained at Government farms and also for its propaganda value, and for trial of such simple experiments as optimum seedrate varietal trials, use of green manuring or fertilizers, time of sowing, rotation and spacing. For this a subsidy of Rs. 200 or so will be required for each farm so that if 20 farms are selected for each of the three areas, the total amount required will be of the order of Rs. 12,000. In addition to this, in order to create confidence in the mind of the cultivator on whose farm demonstrations are done that recommendations made by the department will not result in financial loss to him, it is necessary to give assurance to indemnify the cultivator in case of loss—although it must be said on the basis of experience in other states that there is hardly any possibility of any such losses. The demonstration plots, to be selected should be near market places or along road-sides, in the interest of maximum-publicity. It was particularly emphasised by the Minister that it is not so much the need of water as its proper use which requires special emphasis during demonstration. Further, demonstration must be on private farms of representative types in size of holding, level of fertility and financial resources of the owner etc.

8. Apart from the agronomic experiments referred to above, the research staff in the Agricultural Chemistry Section will have to be strengthened to carry out experiments on kankar layers and hard pan referred to in the report, which will necessitate an expenditure of about Rs. 10,000, per year.

9. As regards soil conservation, the Agricultural Department has already got special section for the purpose with six soil conservation units working in Madhya Bharat region alone but they are fully engaged in normal work. Accordingly extra staff and facilities will be needed for giving concentrated attention in Chambal Project command area We consider that two units

comprising 15 Bulldozers each for each of the three zones, coming under Chambal Valley Project should be provided, for which the estimates would be prepared in the course of a few days. The possibility of private enterprise taking up this work may also be examined.

In addition to above, giving of large areas of undeveloped waste lands to individuals or groups for purpose of development, for a period of 25 years with certain conditions including exemption from "ceiling" will also be considered by the State Government in as much as, it will expedite the development of the area, increase agricultural production and supplement the financial resources of the State.

10. *Betterment levy*.—Steps should be taken for enactment by 1958-59 of a law for imposing betterment levy so that the Act should be ready by the time irrigation starts. It was considered that it should be possible to increase the period and number of instalments for recovering betterment levy.

11. *Gohad tehsil*.—It was fully agreed that water-logging and alkalinity problems will assume a serious shape particularly in Gohad area if canal irrigation water is supplied without taking necessary precautions as referred to in the report, as has already been the bad experience both in this State as well as in other places. It will be unwise to treat this matter lightly.

12. *Sugarcane belts*.—The meeting endorsed the recommendation for creating special 'sugarcane belts' where sugarcane cultivation may be concentrated and sugar mills situated in the centre of cane area. This opportunity, if not availed of immediately, would be lost for ever; and we suggest that a small Committee with one representative from Agriculture, Revenue, Industry, Irrigation, Co-operative Departments may be immediately appointed to select the areas for the purpose to locate such areas before canals, distributaries and minors are dug so that they could be so planned as to provide necessary amount of water for such areas. The other question whether the mills are to be run on co-operative basis or by private parties should also be immediately settled. So far as Agriculture Department is concerned, (after such areas are selected) necessary preparation will have to be made immediately for introducing suitable varieties of cane in that area.

13. *Horticultural industry*.—The meeting supported the idea of developing horticultural industry, cold storage, fruit and vegetable preservation which have got very big scope and which can greatly help in the economic amelioration of the agricultural community. In this connection the Minister for Agriculture, commended detailed study of the co-operative garden colony scheme started in the Punjab and also to discuss at length the desirability of starting a big commercial garden of a few thousand acres within which fruit preservation factory, cold storage etc. etc. may be installed. The cost and its details should be worked out by the department promptly. What is immediately required is the production of nursery

plants from trees of outstanding merit. Although the scheme if it is run efficiently will ultimately become self-supporting and Government will not have to suffer any loss in the long run, necessary provision will have to be made to start nursery work at the three government farms. One Horticultural Development Officer with three Assistants would be needed for survey, propaganda and advisory work.

14. *Ber bushes.*—The meeting agreed with the observations made in the report, both in regard to the serious nature of this menace and the desirability of exterminating it. The Agriculture Department will take immediate steps to work out the comparative cost of eradicating it by weedicide or tractorisation, before any recommendation is made to the agriculturists.

15. *Green manuring.*—In order to encourage the practice of green manuring to maintain fertility of soil, the irrigation charges be waived on green manuring crops as recommended in the report and as practised in the Punjab. Further since the yield of milch animals in Madhya Pradesh is low on account of shortage of green fodder and poor breed, it would seem desirable to remit 50 per cent of the irrigation charges in case of fodder crops like Berseem, Senji, Shoftol etc.

16. *Special staff.*—For giving concentrated attention to the development of Chambal Project Area, additional staff is urgently required comprising of one Chambal Development Officer of the status of at least Divisional Officer drawn from Agricultural Department with one Assistant Director and three Assistants in each of the three tracts in the commanded area for intensive development of sugarcane, horticulture, cotton etc., supply of seeds and fertilizers and necessary guidance in all agricultural matters.

17. The meeting also agreed with other recommendations made in the report such as (a) layout of model villages on the pattern of canal colonies of West Punjab on some other approved pattern (b) preventing haphazard growth of townships in the area (c) improvement of roads and tree plantation etc.

18. Since change over from dry farming to wet farming would involve considerable expenditure on the part of the cultivators, necessary financial accommodation in the form of loan would be necessary for which financial arrangements either from Co-operative Banks or from other sources will have to be made.

19. Lastly the meeting strongly feel the necessity of having a High Power Committee which should have the representatives of Planning, Agriculture, Revenue, Irrigation, Finance, Industry Departments of the State and the Planning Commission. This Committee should have the final power both in regard to planning and execution of schemes and for issuing financial sanction in order to avoid unnecessary delay as time factor is the essence of the success of the Project, and any avoidable delay may defeat the objectives in view.

APPENDIX XVII

CHAMBAL VALLEY PROJECT

PROCEEDINGS OF THE MEETING HELD ON 11TH SEPTEMBER 1957 AT 3 P.M.
IN THE OFFICE ROOM OF SHRI TAKHAT MAL JAIN, MINISTER FOR
AGRICULTURE AND INDUSTRIES AT BHOPAL.

The following were present:—

1. Shri Takhat Mal Jain, Minister for Agriculture and Industries, Madhya Pradesh—*Chairman*.
2. Shri Shankarlal Tiwari, Minister for P.W.D. & Irrigation, Madhya Pradesh.
3. Sardar Lal Singh, Member, Irrigation & Power Team, Planning Commission, Government of India, New Delhi.
4. Shri R. C. Murab, I.A.S., Secretary Agriculture, Madhya Pradesh.
5. Shri S. L. Sood, Chief Engineer, P.W.D. and Irrigation, Madhya Pradesh.
6. Shri A. K. Char, Chief Engineer, Chambal Hydel Scheme, Madhya Pradesh.
7. Shri N. S. Apte, Director of Agriculture, Madhya Pradesh.
8. Dr. T. R. Mehta, Joint Director of Agriculture (Research), Madhya Pradesh.
9. Shri Y. G. Mane, Superintending Engineer, Chambal Canal Circle.
10. Shri R. S. Verma, I.A.S., Deputy Secretary Agriculture, Madhya Pradesh.
11. Shri Patil, Superintending Engineer, P.W.D., Building and Roads, Madhya Pradesh.
12. Dr. C. B. L. Bhargawa, Deputy Director of Agriculture, Gwalior, Madhya Pradesh.
13. Shri P. N. Baijal, Agriculture Engineer, Gwalior, Madhya Pradesh.

The proceedings of the meeting, held at Gwalior on 6th to 8th September, 1957 at technical level to discuss the financial implications of

schemes and proposals contained in the report of Sardar Lal Singh on Agricultural Aspect of Chambal Valley Project, were discussed in the meeting. These proceedings had been circulated to the members beforehand. Other problems (Item No. X), relating to departments other than Agriculture were taken up first.

1. In regard to the need for verification of C.C.A. and G.C.A. the Chief Engineer, Chambal, explained at length that the areas unsuited for irrigation had already been left out of calculation and no less than 3 lakhs of acres coming under ravines or otherwise unfit for irrigation had been excluded. He expressed the belief that there would not be any great difference between the C.C.A. calculated on the basis of revenue records and the C.C.A. actually existing on the spot.

2. *Water logging and salt contents.*—The meeting agreed that the Chief Engineer (Irrigation) should examine the problems in Gohad and Mehgaon area and submit a report within a month stating the measures to be adopted. It was further suggested that the canal and drainage programme in the whole Chambal Project area should go hand in hand and the Chief Engineer (Chambal) will take necessary action.

3. *Consolidation of holdings.*—It was explained that this was already included in the Second Five Year Plan although it was not given a high priority. It was deemed proper that the work of consolidation might be started in the area which is to come first under the irrigation project, in order to gain experience and demonstrate its beneficial results.

4. *Ber bushes.*—The meeting reaffirmed the stand* taken on this point at the meeting held on 23rd July, 1957.

5. *Phased programme.*—The Chief Engineer, Chambal, stated that if the period of 10 years estimated by the Canal Authorities for full utilisation of water by the cultivators, could be reduced, it would indeed be most welcome as it will greatly improve the financial success of the scheme; and the necessary propaganda as suggested in the report should be conducted to make the cultivators irrigation-minded.

6. *Commercial fruit gardens.*—The meeting agreed with the suggestion of bringing an area of five thousand acres or so under fruit plantation. The Chief Engineer, Chambal, stated that it would be possible to spare necessary area out of Government waste lands. The Agriculture Department was to select the area and to send up the proposals with financial implications of the same.

7. *Sugar industry.*—The meeting endorsed the recommendations made in the report of Sardar Lal Singh and suggested the appointment of a Committee comprising (a) Superintending Engineer, Chambal Canal Circle, Sheopur (b) Deputy Director of Agriculture, Gwalior Division (c)

Sugarcane Development Officer (Industries Department) and (d) Agricultural Chemist—the terms of reference of the Committee being survey of the area with a view to select suitable sites from the view point of (i) suitability of soil for sugarcane (ii) nearness to Railway Station (iii) abundance of water supply. The Committee would select 7, 8 sites out of which 5 may be finally selected, as Chambal Valley Area could easily feed five Sugar Mills.

8. *Green manuring.*—The meeting reaffirmed the stand* taken on this point at the meeting held on 23rd July, 1957.

9. *Construction of pucca road, planning of new village and mandis, towns, etc.*—The meeting suggested that a Committee be appointed by the Government to work out the details.

10. *Co-operative garden schemes.*—The meeting agreed that policy decision as to the section, Agriculture or Co-operation, under which this work has to be placed be taken first.

11. *Warabandi & construction of main channels.*—As regards *Warabandi* referred to in the report, the Superintending Engineer, Mr. Mani is to proceed to Punjab in the third week of this month to study the system there. (Since then he has already been there).

As regards the *construction of main channels*, it was deemed proper that while the main channels will be constructed by the villagers, the necessary technical guidance be made available by the Irrigation Department, Chief Engineer Chambal was to take necessary steps for the same.

12. *High Power Committee.*—Secretary Agriculture will put up a note regarding the composition and the specific functions of the Committee.

As regards Joint Committee of Agriculture Departments of Rajasthan and Madhya Pradesh, the proposal was deemed workable. It was suggested that a Committee be formed immediately to start functioning, as the exchange of views between the two State Agriculture Departments would be advantageous to both the States, both in the matter of economy and efficiency of work and avoiding duplication of efforts. The Secretary Agriculture will take necessary action.

After the items referred to above (coming under Para. X of Technical Committee Report) were disposed of, the financial implications of various schemes as worked out by the Technical Committee and numbered I to IX given below were seen and it was felt that these amounts will be outside the State Plan and it was understood that the Central Government may come forth for full assistance on all the items.

No. I.—Varietal and cultural experiments on three Government Farms involving an expenditure of Rs. 52,000 per year.

No. II.—Experimental-cum-demonstration work.—One private demonstration farm, within an area of every 10 square miles, aggregating in all, 150 farms in three zones were to cost Rs. 30,000 per year.

No. III.—Kankar Layer and hard pan.—(a) There was no need of duplication and that this work need not be started here when Rajasthan Agriculture Department was proposing to do it.

(b) It was felt that the present staff engaged in Soil Survey and analysis work needs to be strengthened. The total cost will be Rs. 59,000 per year.

No. IV.—Study in irrigation practices to determine the water requirement for various crops was to cost Rs. 16,000 per year.

No. V.—Irrigation and land development.—It was felt that in order to make the best use of irrigation facilities, the land must be levelled otherwise canal irrigation is likely to do more harm than good, if water is applied to uneven lands. This involves a total expenditure of Rs. 34·5 lakhs including Rs. 28·5 lakhs non-recurring on purchase of machinery in the first year and about Rs. 6·8 lakhs per year in subsequent years. Cost of levelling the land could be recovered from the owners. In regard to 3 alternatives whether:—

- (a) the work should be done by the State Agriculture Department on the same lines as bull-dozing work; or
 - (b) the work should be done by private agency; or
 - (c) both Government agency and private agency,
- it was suggested that the Secretary Agriculture will get it examined at expert level.

No. VI.—Horticulture development.—(a) Production of nursery plants for supply to public involves an expenditure of Rs. 1,46,000 in the first year and about Rs. 85,000 per year in subsequent years.

- (b) Staff for advisory work would cost Rs. 34,000 per year.
- (c) Establishment of demonstration-cum-experimental gardens on three Government farms will cost Rs. 30,000 in the first year and Rs. 13,000 per year in subsequent years.

The above items were deemed proper.

No. VII & IX.—Strengthening of District Staff for extension work in Agriculture: Overall supervision and co-ordination of work.—The Technical Committee meeting at Gwalior suggested the appointment of a Development Officer of a high status, or to entrust this work to the present Deputy Director of Agriculture, Gwalior, and strengthen his staff. However, it was deemed proper to have a special staff for Chambal area alone if funds permitted.

No. VIII.—Publicity and propaganda section.—It will involve an expenditure of Rs. 50,000 in the first year and Rs. 20,000 per year in subsequent years.

Sd./ DURGA PRASAD,
Under Secy. to the Govt. of Madhya Pradesh,
Agriculture Department.

*To make the above proceedings self contained, proceedings of the meeting of July 23rd in regard to *ber* bushes & green manuring are reproduced below:—

Ber bushes: The meeting agreed with, the observations made in the report, both in regard to the serious nature of this menace and the desirability of exterminating it. The Agriculture Department will take immediate steps to work out the comparative cost eradicating it by weedicide or tractorisation, before any recommendation is made to the agriculturists.

Green manuring: In order to encourage the practice of green manuring to maintain fertility of soil, the irrigation charges be waived on green manuring crops as recommended in the report and as practised in the Punjab. Further since the yield of milch animals in Madhya Pradesh is low on account of shortage of green fodder and poor breed, it would seem desirable to remit 50 per cent of the irrigation charges in case of fodder crops like Berseem, Senji, Shaftol etc.



APPENDIX XVIII

Shri M. L. Sood, I.S.E.,
Chief Engineer Irrigation,
Madhya Pradesh.

D.O. No. 415-U/W(i)/56
Office of the Chief Engineer,
Irrigation, Madhya Pradesh.
Raipur, the 6th Dec. '57.

My dear Shri Lal Singh,

Many thanks for your letter No. COPP/I&P/III, dated 19/20th November, 1957. I am sorry to learn that you have been down with heart attack. I hope that you will recover quickly and attain the normal state of health soon.

2. Shri Char, Chief Engineer, Chambal and I accompanied by the Superintending Engineers and Executive Engineers concerned inspected the commanded area of Bhind Canal System. In the Gohad and Mehgaon area, Rabi crop is doing as well as anywhere else in the commanded area. A few patches of usar with white salts on top are there, as I had witnessed with a much higher intensity in Manipur, Etawah and Cawnpur districts of the U.P. when I was Executive Engineer Canals at Etawah. There even, though the spring level during Monsoons came up quite close to ground level but there was no water-logging problem and crops did quite well except on those patches which were believed to be due to lack of underground drainage owing to underlying kankar layers. To my mind this appears to be a case of absolute lack of drainage facilities. Wherever irrigation is introduced and the country is as flat as this tract, it is absolutely essential to have a suitably laid out drainage system to dispose of rain water and the seepage water. Shri Char and I have agreed that ample provision will be made in the proposals for remodelling Bhind to provide an elaborate drainage system. Also I have issued instructions that a record of spring levels in the wells in this tract should be maintained. Both, depths of water levels from ground level and their reduced levels should be recorded twice a year, once before the Monsoon in May and again after the Monsoon in October. Besides I am requesting Dr. Mehta, to study subsoil conditions up to 10 ft. depth in Gohad and Mehgaon areas with a view to ascertain the nature of the soil contents with particular reference to the presence of salts, and the perviousness as related to under-ground drainage. I understand from Dr. Mehta that a provision for such studies has already been made as item No. III in the proposals framed under your advice, in the meeting of 6th to 8th December, at Gwalior.

3. I am enclosing herewith a copy of Shri R. J. Dhumal, Deputy Chief Engineer's inspection note of 28th September, 1957 in this connection.

With kind regards.

Yours sincerely,
Sd./- M. L. Sood.

Shri. Lal Singh,
Adviser Agriculture,
Planning Commission,
Kotah House,
New Delhi.

*Water logging in Mehgaon and Gohad area of Bhind Canal System,
District Bhind.*

Date of Inspection 27th September, 1957

The following were present:—

1. Shri V. L. Athawale, Superintending Engineer, Irrigation Survey Circle, Madhya Pradesh, Gwalior.
2. Shri Y. K. Patil, Superintending Engineer, P.W.D., and Irrigation, Madhya Pradesh, Gwalior Circle.
3. Shri G. M. Tikekar, Assistant Director, Agriculture, Gwalior.
4. Shri S. S. Yadav, Research Assistant, Agriculture, Gwalior.
5. Shri Horam Singh Sharma, Assistant Engineer, P.W.D. and Irrigation Sub-Division, Gohad.
6. Shri B. K. Agrawal, Assistant Engineer, C.E's Office, Irrigation Branch, Gwalior.

1. The Agriculture Department has prepared a statement of soil analysis for the area falling under the Chambal Canal in this tract. The statement was studied and some spots were visited.

2. *Bara area.*—The villages worstly affected by the stagnant water ponds of rains and canal water were seen. It is possible to drain off this area after completing the contour survey. The country is so flat that the ground slope is one foot per mile. It is very difficult to trace natural drainage lines. Artificial drains can be constructed and the drainage would be discharged in the Baisly River which is situated at a distance of 5 to 10 miles from the canal system. Sub soil water level of wells after taking readings in this area which is mostly submerged in rainy season, was also noted. The sub-soil water level is from 4 ft. to 10 ft. below ground level in certain localities which are adjacent to the standing water either due to rains or wastage from the water courses.

3. *Area near Khander and Nibrol villages on Gohand Mho road.*—This area is not under the command of the existing Bhind canal, but it will come under the remodelled Bhind canal in connection with the Chambal Canal

Scheme. There were stagnant pools of water due to recent rains and the water level in the wells was from 3ft. to 5 ft. below ground level.

4. *Pipandi, Kanipura and Tehra area.*—The canal was running full for paddy crops and fields were full of water as the irrigation was in progress. The water in the adjoining wells was 4 ft. below ground level.

5. The area around Mehgaon and Gohad is very flat. In heavy rains when the fields get flooded with water, they are not drained off for days together. In many places natural drainages are not existing and the ground slope is also very flat and obstructed by the embankment of the road or the railway or the canal.

6. The cultivators usually drain out the water by breaching canals which is no doubt very objectionable especially in Chandokher, Sherpur and Br. distributory area. This is already a saline area.

7. To minimise the effects of seepage from canal the present Bhind Canal needs lining in usar (saline) soil portions.

8. The area could be improved by providing elaborate drainage system. It is desirable that surveys should be taken up by the Chambal Scheme authorities along with the remodelling of Bhind Canal system. Only in places where seepage and stagnant water is excessive as stated in para. 6, drainage of the area could be executed by the Executive Engineer, Bhind. Remaining areas will have to be carefully surveyed and efficient drainage system will have to be designed along with the remodelling of the Bhind Canal by the Chambal Organisation. The Chief Engineer Irrigation has already suggested to get the area surveyed through the Director, Surveys Department, Government of India.

9. In usar area, tube wells should be tried and when these are successful, irrigation from canal water should be stopped.

10. Drainage culverts should be constructed where road, railway and canal embankments obstruct the rain water flow and water has to pass along the fields to a longer distance parallel to the obstructions, till they meet some drainage crossings.

11. The Chambal Organisation should be requested to survey the Bhind Canal area along with the remodelling of the Bhind Canal and to provide suitable measures for the drainage of this area.

At some points as mentioned in para. 6 where drainage arrangements are to be provided by the department, first phase estimates of these schemes should be submitted by the Superintending Engineer as early as possible.

In Gohad and Mehgaon tract the patches of saline soils were in existence long before the canal was constructed. Even salt was also being manufactured by villagers in old days from some of the saline spots in the area. Water level in the wells in most of the area is very low. Only in few places near stagnant pools of water, the water level in the wells is high. Even in

this area the out-turn of crop is still not affected at present, it is likely to be affected in future. The area which may show signs of water logging is confined in some isolated patches near the pools of water. The drainage arrangement for such areas is necessary. The saline areas which were in existence long before the canal was constructed were not considered suitable for cultivation. Recently some paddy cultivation is started in the saline area by Punjabi cultivators. It will be better to have the area investigated by Chambal Organisation in connection with the surveys and projects of remodelling of Bhind Canal.

Sd./- R. J. DHUMAL,--28-9-57.

Dy. Chief Engineer (N), P.W.D., Irrigation Branch,
Madhya Pradesh, Raipur.



APPENDIX XIX

PROCEEDINGS OF THE MEETING

A meeting of the officers of Agriculture Department was held in the office of Director of Agriculture Rajasthan, on August 1st. The following were present.

1. Sardar Lal Singh, Member I & P Team.
 2. Shri Samrat Raj, Dir. Agriculture Rajasthan.
 3. Shri S. Shamsher Singh, Dy. Dir. Agricultural (Adm).
 4. Shri M. P. Bhatnagar, Economic Botanist.
 5. Shri K. M. Mehta, Agricultural Chemist.
 6. Shri M. C. Joshi, Sugarcane Development Officer.
 7. Shri H. C. Kothari, Statistician.
 8. Shri S. D. Mathur, Plant Protection Officer.
 9. Shri U. S. Badal, Assistant Food Commissioner.
2. The report prepared by Sardar Lal Singh, Member, Irrigation & Power Team, Planning Commission, on agricultural aspect of Chambal Valley Project was discussed at length both in the Forenoon and in the Afternoon. After each and every item was explained at length, the Members discussed and fully supported all the observations, recommendations and proposals contained in the report.
- 3 In connection with the phased programme, the Director of Agriculture felt, and all other Members agreed with him, that the period of 10 years estimated by the Canal Department for full utilisation of canal water was too long and it could be curtailed by 4 years, if not more, provided of course that necessary facilities and requirements of the schemes are made available to enable the Agriculture Department to implement them. The Director of Agriculture further suggested that since a number of agricultural problems facing both Madhya Pradesh and Rajasthan States in connection with Chambal Valley Project, are common, it would be desirable to create a common Board consisting of representatives of both the States to consider the same and take decisions under the guidance of Sardar Lal Singh. This suggestion of the Director was supported by all Members.
- Further the Agriculture Department of Rajasthan fully agree with the views expressed in the report of Sardar Lal Singh that even the very financial success of the Chambal Valley Project would be in jeopardy unless the agricultural problems referred to in the report, are attended to—in fact the extent of success of the Project will depend upon the extent to which the suggestions given in the Report are implemented.

It was further decided that the financial implication of each scheme may be worked out, after the Report has been discussed with the Hon'ble Minister for Agriculture this Afternoon.

(Sd.) SAMRATH RAJ,

1/8

Director of Agriculture, Rajasthan, Jaipur..



APPENDIX XX-A

Minute Recorded by the Minister for Agriculture, Government of Rajasthan

The report of the Technical Committee was placed before the Minister of Agriculture where the Agriculture Secretary, the Director of Agriculture and the Deputy Director of Agriculture were present. All the aspects of Chambal Valley Project were discussed which were explained in very great detail by Shri Lal Singh, Member Irrigation and Power Team, Planning Commission. The report of Shri Lal Singh is a very learned discourse on various aspects of agricultural improvements that have to be brought about in the Cultural Commanded Area of the Chambal Project. All the proposals, recommendations and observations regarding agriculture that have been made in the report are generally approved of. Although it may be beyond the financial resources of the State Government to implement all the suggestions that have been given by Shri Lal Singh Ji yet it was strongly felt that unless those suggestions are implemented, Project may not prove a boon to the cultivators. The Minister of Agriculture, however, desired that financial implications of these schemes may be worked out by Agriculture Department in consultation with Shri Lal Singh Ji.

It was strongly felt that we must post the publicity Section immediately in the Kotah Barrage in order to educate the cultivators and also make them canal conscious. Unless this is done the cultivators may not take full advantage of the irrigation facilities. This suggestion of Rajasthan Government was agreed to by Shri Lal Singh.

It will be appreciated if Shri Lal Singh Ji could pay more frequent visits to Rajasthan to advise us on various aspects of agriculture in Chambal.

(Sd.) NATHU RAM MIRDHA 2/8,
Minister for Agriculture Rajasthan, Jaipur.

APPENDIX XX

Minutes of the Meeting with Representatives of Rajasthan Government held at 9 A.M. on the 15th September, 1957, in the Multi-storeyed Building, Queen Victoria Road, New Delhi.

PRESENT:

Shri N. V. Gadgil, Leader (in the chair).
Shri Mohan Lal Sukhadia, Chief Minister, Rajasthan.
Shri Lal Singh, Member, Irrigation & Power Team.
Shri Balwant Singh, Secretary, Rajasthan Government, Irrigation & Agriculture Departments.
Shri Moti Ram, Chief Engineer, Irrigation Rajasthan.
Shri Samrath Raj, Director of Agriculture, Rajasthan.
Shri D. S. Borker, Secretary, Consultative Committee on Irrigation & Power Projects and Irrigation & Power Team.

IN ATTENDANCE:

Shri Samsher Singh, Deputy Director, Agriculture Rajasthan.
Shri K. M. Mehta, Agricultural Chemist, Rajasthan.
Shri U. S. Badal, Assistant Food Commissioner, Rajasthan.

Shri N. V. Gadgil, the Leader, initiated the discussions by pointing out that the utilisation aspects of both power and water were not gone into sufficient detail and the latter subject only was intended to be discussed at this meeting. He pointed out that Irrigation & Power Teams' approach in the matter had been already discussed with Madhya Pradesh Government and the same procedure was to be followed for Rajasthan for obtaining the State Government's approval, subject to any amendments that they might like to suggest in the course of discussions.

2. Shri Lal Singh made it clear that the proposals were already finalized with the Madhya Pradesh Government in a Meeting which was attended, besides the Minister for Agriculture and Industries and the Minister for Irrigation, by the Secretaries and Heads of Departments concerned. He further explained that so far as Rajasthan was concerned, agricultural problems had been discussed in a meeting attended by the Ministers, Secretaries and the officers of Irrigation and Agriculture Departments and they had approved of the recommendations and proposals contained in the report. The financial implications of the proposals were being worked out. The object of the present meeting was to secure the opinion and approval

of the Chief Minister to the recommendations contained in the report. Shri Lal Singh explained briefly the salient points made out in the report. He emphasised that agriculturists in Kotah-Bundi area commanded by the Chambal Project, were accustomed to depend on rainfall and the rainfall being ample the Kharif crops were successfully grown without much artificial irrigation. He expressed the opinion that it would be too optimistic to assume that the cultivators would readily take to the use of canal water for irrigating Kharif crops and pay water rates. If they were expected to pay water rates and betterment fees, they need to be convinced about the better yields resulting from canal irrigation. This would require effective demonstration and propaganda based on the results of actual experiments. He referred to the tremendous scope for developing horticulture in Rajasthan since the climatic conditions were very favourable, besides plentiful supply of canal water. He suggested that production of nursery plants of reliable varieties could be undertaken *on a self-supporting basis* even if the plants were to be supplied to the farmers at a price lower than that charged by private nurserymen.

3. Shri Lal Singh dwelt on the possibility of development of sugar industry—both cane production and sugar manufacture, which had enormous scope in Rajasthan due to good soil, suitable climate which is free from frost and ample supply of canal water. He proposed the creation of 'sugarcane belts' for intensive cultivation of sugarcane, after a careful study of soils, availability of irrigation water, marketing facilities and railway communications etc. had been undertaken. Since sugarcane required much more water than most other crops, sugarcane belts will have to be provided a large quantity of irrigation water from the very beginning. This will, of course, bring greater return to Government on account of higher irrigation charges on the area under sugarcane crop which incidentally will help in the prosperity of the area. He also stressed the need for carrying out experiments like varietal trials to determine the varieties of crops best suited under irrigated conditions as also their irrigational and manurial requirements, seed rate etc. He referred to the possible troubles due to the existence of Kankar layer and hard pan at many places and the need for carrying out experiments.

4. When asked by Shri Gadgil as to what the experience of Rajasthan Government was in this respect, the Chief Minister, Rajasthan, replied that experiments in this regard had not yet been completed. Shri Lal Singh further referred to the problem of water-logging and alkalinity in parts of Rajasthan even though this problem was more serious in certain areas of Madhya Pradesh. Shri Balwant Singh reported that these problems were not likely to be of a serious nature in the Chambal area. Shri Lal Singh said that examination of about 20 per cent of the existing wells had indicated that there was likelihood of this trouble in some areas and he wanted that 50 per cent of the wells may be brought under examination in order to get a better idea of the extent of these problems. This was agreed to.

5. Shri Gadgil expressed anxiety that all these experiments should be completed by the end of June, 1959, so that results thereof could be applied on the fields when water would be available for irrigation. He assumed that the Government of Rajasthan had agreed to the formation of 'sugar-cane belts'. He proposed that useful information regarding the amount of water required for sugarcane cultivation should be ascertained from the Bombay Government as cultivation of sugarcane was done on a fairly large scale in that State. Shri Lal Singh was requested to supply to Rajasthan Government a list of detailed items to which the Madhya Pradesh Government had agreed to.

6. Shri Mohan Lal Sukhadia, Chief Minister, Rajasthan, generally agreed with the suggestions and proposals made in the Report. He added that the Rajasthan Government will have to approach the Central Government for extra funds and necessary sanction for putting up sugar mills in the area.

7. Shri N. V. Gadgil concluded that the Planning Commission will have to be approached for such extra grants after the financial implications of the schemes had been worked out in some detail. He thought that normally there should be no difficulty in securing the necessary grants, provided the schemes were not of large magnitudes.



APPENDIX XX-A

Record of discussions held between Shri Lal Singh and the Representatives of Rajasthan Government at technical level on 15th September, 1957, in the Multi-storeyed Building, Queen Victoria Road, New Delhi.

PRESENT:

Shri Lal Singh, Member, Irrigation & Power Team.

Shri Balwant Singh, Secretary Rajasthan Government, Irrigation & Agriculture Departments.

Shri Moti Ram, Chief Engineer, Irrigation Rajasthan.

Shri Samrath Raj, Director of Agriculture, Rajasthan.

Shri Samsher Singh, Deputy Director Agriculture, Rajasthan.

Shri K. M. Mehta, Agricultural Chemist, Rajasthan.

Shri U. S. Badal, Assistant Food Commissioner, Rajasthan.

Since the Chief Minister Rajasthan and Leader, Irrigation & Power Team had to leave the meeting to attend to some other urgent work, they asked the remaining Members to continue discussion on technical aspect of the report, also to work out the financial implications of the schemes and to secure as far as possible, unanimity of opinion between the Irrigation & Agriculture Departments of Rajasthan on various matters referred to in the report. Accordingly the matters pertaining to both Irrigation and Agriculture Departments were taken up first.

1. *Water-logging and high salt contents.*—It had already been agreed to, previously in the meeting, that since the examination of 20 per cent of the existing percolation wells had disclosed high salt content in sub-soil water and high ground water level in certain areas, which were of disquieting nature, it was desirable to intensify this work, so as to include examination of about 50 per cent of the existing wells to secure more reliable and authentic information and this matter be taken up immediately.

2. *Need for verification of C. C. in Kotah area.*—Although Chief Engineer (Shri Moti Ram) felt that there was not likely to be very great difference in the C. C. A. as (a) theoretically calculated by Irrigation Department on the basis of figures from revenue record and (b) what actually exists on the spot, yet there was no harm in investigating this matter further; and for this purpose a Committee of two persons namely Agricultural Chemist Rajasthan and a Representative of Irrigation Department (to be nominated by Shri Moti Ram) may go into this matter. They may compare the figures, as obtained from revenue records, with those compiled by the Agricultural Chemist as a result of his survey about the irrigability of various lands. The work is to be undertaken immediately so that if there is found to be any appreciable difference between the two

figures, needful could be done before the construction of distributaries and minors in certain specified areas.

3. *Hard pan and kankar layers.*—Both Irrigation and Agriculture Departments agreed on the need of carrying out the experiments as referred to in the report.

4. *Soil erosion.*—It was unanimously agreed that this problem was of a most serious nature and requires to be given top-most priority. But since this is a problem not entirely concerned with Chambal Project, the matter may be taken up separately.

5. *Ber bushes.*—Both Departments agreed that removal of this pernicious bush which is a serious pest, will certainly help in better utilisation of canal water.

6. *Phased programme.*—The Canal authorities consider that it would take 10 years before available water begins to be fully utilised by the cultivators. If this period can be curtailed by means of necessary propaganda or publicity as suggested in the report, the Irrigation Department would naturally welcome every such proposal as this will still further improve the financial aspect of Chambal Project.

7. *Horticulture industry and sugarcane belts.*—Irrigation authorities agreed with Agricultural Department about the scope of development of horticulture and sugar industry referred to in the report, and with the proposal of ear-marking suitable areas as "sugarcane belts" where intensive cultivation of sugarcane may be resorted to, with sugar-mills installed in the centre of cane areas. The Chief Engineer stated that if such areas are immediately ear-marked, his Department will have no difficulty in arranging enhanced supply of water for such areas, if necessary by suitable modification in the capacities of the minors or distributaries concerned. Likewise for fruit gardening also which requires greater supply of water than usual field crops do, the Canal Department will have no difficulty in arranging necessary supply of water.

8. *Green manuring.*—Irrigation Department agreed with the Agriculture Department to the recommendations made in the report to remit irrigation charges in full in the case of green manure crops to maintain fertility of soil and to charge only 50 per cent irrigation rates in case of fodder crops like Senji, Berseem and Shaftol in the interest of dairy industry and animal husbandry.

9. *Development of land to make it fit for irrigation.*—The Canal Department agreed with the Agriculture Department on the need for developing the lands by levelling, contour bunding etc. so as to make them fit for flow irrigation. All Members agreed that if any scheme on the lines planned out in Madhya Pradesh whereby lands could be developed and cost recovered from the land owners through easy instalments, could be started in Rajasthan also, it should immensely help in utilising canal water most profitably, to the advantage of both the cultivator and the Government.

10. *In regard to construction of main field channels.*—It was agreed that while this work cannot be undertaken by the Irrigation Department and it must remain the responsibility of the villagers themselves, yet technical guidance must be provided by the Irrigation Department so that the channels are aligned and laid out properly.

11. *Financial implications of schemes.*—After the matters pertaining to both Agriculture and Irrigation Departments were gone over, the financial implications of various schemes which had already been submitted by the Director of Agriculture were considered. After some discussion it was decided that Rajasthan Agricultural Department be supplied with copies of schemes along with their financial implications, as already finalised in case of Madhya Pradesh. After these were studied by the Agriculture Department, fresh schemes along with their financial implications would then be put up by the Rajasthan Agriculture Department for consideration. Sardar Lal Singh agreed to supply copies within a course of two, three days.



APPENDIX XXI
SUMMARY OF EXPENDITURE FOR AGRICULTURAL SCHEMES
Madhya Pradesh

Sl. No.	Name of scheme	Amount in thousand rupees	
		First year	Second year
1.	Varietal & cultural experiments . . .	52	52
2.	Experimental and demonstration work . . .	30	30
3.	Kankar layer and hard pan . . .	59	45
4.	Study in irrigation practices . . .	16	8
5.	Irrigation and land development . . .	3450	600
6.	Horticulture development:		
	(a) Plantation of gardens . . .	30	13
	(b) Commercial production of nursery plants . . .	146	88
	(c) Extension & advisory work . . .	34	34
7.	Strengthening of district staff for extension work . . .	12	12
8.	Publicity and propaganda . . .	50	20
9.	Overall supervision and co-ordination of work . . .	19	19
	TOTAL . . .	3898	921
	Total amount recoverable in full (items 5 & 6b). . .	3596	688
	Net expenditure . . .	302	233

N. B. Financial implications of other items have not yet been worked out for want of decision by Government or for other reasons mentioned therein.

APPENDIX XXI-A
SUMMARY OF EXPENDITURE FOR AGRICULTURAL SCHEMES

Rajasthan

Sl. No.	Name of Scheme	Recurring expdr. one year	Recurring expdr. 3 years	Non recurring	Total
1.	Agricultural research . . .	1,16,150	3,48,450	..	3,48,450
2.	Research & experimental farms (4 farms) . . .	1,95,480	5,86,440	9,94,800	15,81,240
3.	(a) Commercial production of nursery plants (3 nurseries) . . .	65,985	1,97,955	60,000	2,57,955
	(b) Plantation of experimental-cum-demonstration gardens (3 farms) . . .	30,000	90,000		90,000
4.	Plant protection staff scheme . . .	1,03,660	3,10,980	46,700	3,57,680
5.	Scheme for soil erosion and land development for irrigation . . .	1,50,000	4,50,000	5,67,000	10,17,000 / 30 19,83,000 / lakhs.
6.	Intensive agricultural work particularly sugarcane development . . .	49,160	1,47,480	18,750	1,66,230
7.	Investigation of marketing conditions . . .	9,000	27,900	..	27,900
8.	Publicity & propaganda . . .	19,500	58,500	32,500	91,000
9.	Senior officers allowance . . .	2,400	7,200	..	7,200
	TOTAL . . .	7,41,335	22,24,905	17,19,750	59,27,655

Note : In regard to recurring expenditure, as already explained in the Memorandum, full expenditure under item 3.(a)(production of nursery plants)

and under item 5 (on land development) is expected to be recovered; as also a sum of Rs. 50,000/- per year from the crop sale of experimental farms under item 2, so that net annual recurring expenditure will be of the order of about Rs. 4.8 lakhs or for 3 years about Rs. 15 lakhs.

In regard to the non-recurring expenditure, a sum of Rs. 5.67 lakhs is provided under land development for purchase of bull-dozers etc. and Rs. 19.83 lakhs as reserve for expenditure on levelling land and Rs. 60,000/- under nursery plant and all these expenditures are, expected to be recovered as the work in both cases is to be done 'on no profit no loss basis'. Besides an expenditure of about Rs. 97,000/- provided under items 4, 6 & 8, there is also a provision of Rs. 9.94 lakhs for establishing 4 research and experimental farms including cost of building, machinery and price of land if Government land be not available.



APPENDIX XXI—B
INDIAN COUNCIL OF AGRICULTURE RESEARCH
QUEEN VICTORIA ROAD
New Delhi

Dated 25/26th March, 1958

D.O. No. 50(4)/58-CDN

My dear Indarjit Singh,

Will you kindly refer to my D.O. letter No. 42/VR-58, dated the 2nd January, 1958, forwarding Dr. Kalamkar's comments on the note entitled "Agricultural Aspects of Chambal Valley Project"? As has been mentioned by Dr. Kalamkar, assistance from the Indian Council of Agricultural Research can be availed of in the implementation of the following schemes:—

1. Strengthening of research concerning varietal and cultural experiments;
2. Water requirements of various crops (under the scheme of Model Agronomic Experiments);
3. Horticultural Development; and
4. Publicity and Propaganda.

If schemes on the above subjects are submitted by the State Government, the Indian Council of Agricultural Research would be prepared to consider subsidizing them in accordance with the approved pattern of financial assistance. However, the State Government has since finalised their 1958-59 Plan and if they are unable to accommodate the above schemes, the requisite funds should be made available by the Planning Commission from within the Chambal Valley Project estimates. This is to ensure that these important schemes are not held up for want of funds during 1958-59.

Yours sincerely,
(Sd.) M. S. RANDHAWA,

Shri Indarjit Singh,
Joint Secretary and
Secretary, Committee on Plan Projects,
Economy Division,
Ministry of Finance,
New Delhi.